# A330
# TECHNICAL TRAINING MANUAL
# MECHANICAL & AVIONICS COURSE - T1+T2 (LVL 2&3)
# (RR Trent 700)
# E EFIS/ECAM and INSTRUMENTS

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# E EFIS/ECAM AND INSTRUMENTS

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## EIS

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G9409341 - GAUT0T0

# INDICATING SYSTEM LINE MAINTENANCE BRIEFING (2)

## INDICATING SYSTEM - OVERVIEW

### EIS

The EIS shows data to the pilots on six identical and interchangeable Liquid Crystal Display (LCD) units. This EIS is divided into 2 parts:
- the Electronic Flight Instrument System (EFIS) composed of two Primary Flight Displays (PFDs) and two Navigation Displays (NDs),
- the Electronic Centralized Aircraft Monitoring (ECAM) composed of an Engine/Warning Display (EWD) a System Display (SD) and attention getters.

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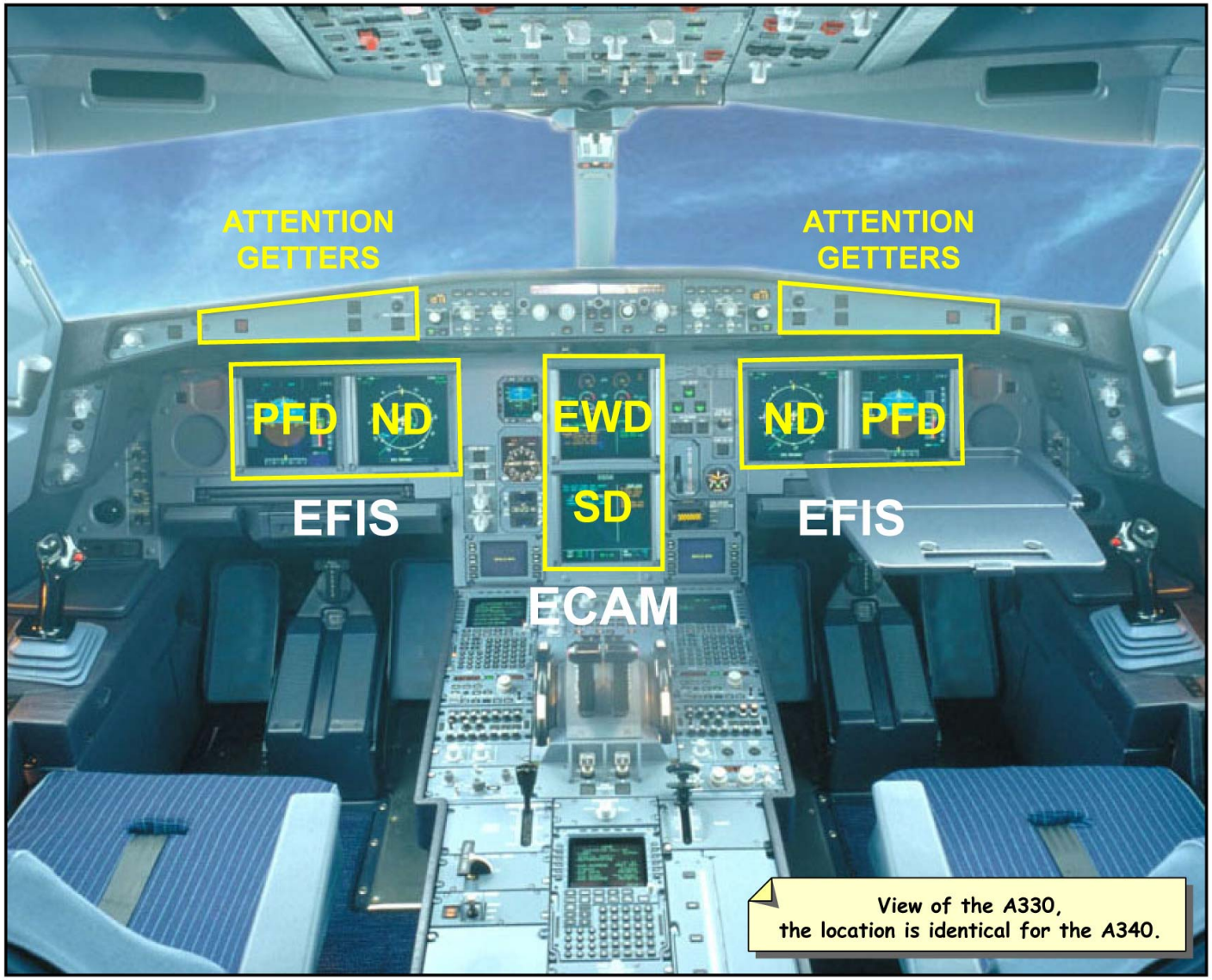


INDICATING SYSTEM - OVERVIEW - EIS

# INDICATING SYSTEM LINE MAINTENANCE BRIEFING (2)

## INDICATING SYSTEM - OVERVIEW (continued)

### PHILOSOPHY

The EIS is an avionics system connected to most of the aircraft systems to fulfill the EFIS and ECAM functions. The EIS comprises 7 computers:
- 3 identical and interchangeable Display Management Computers (DMCs),
- 2 identical and interchangeable Flight Warning Computers (FWCs),
- 2 identical and interchangeable System Data Acquisition Concentrators (SDACs).

The 6 LCD units have the capability to compute and generate symbols to display from data, sent by the DMCs. On the A340-500 and A340-600 aircraft, it is also possible to display video image.

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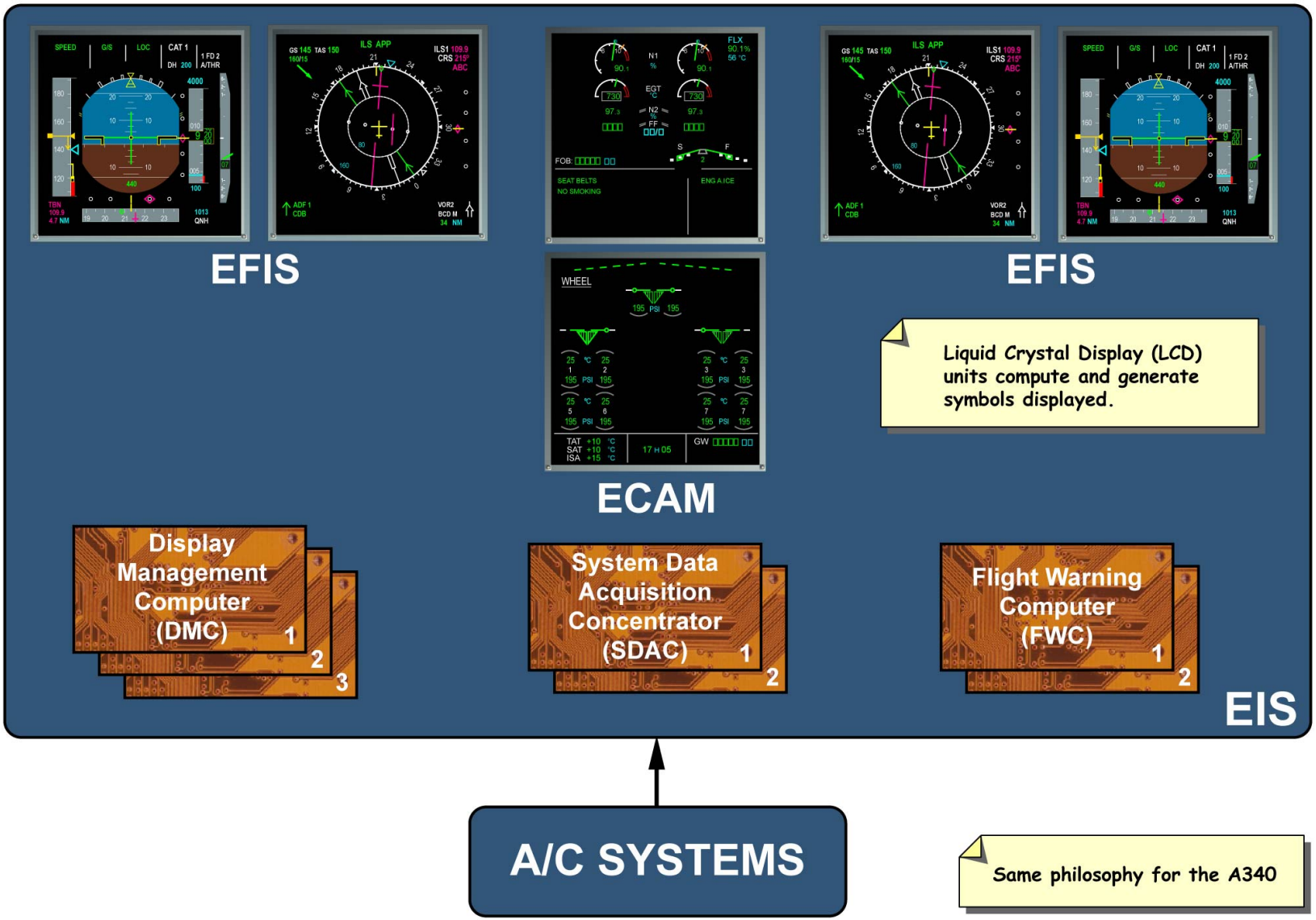


INDICATING SYSTEM - OVERVIEW - PHILOSOPHY

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# INDICATING SYSTEM LINE MAINTENANCE BRIEFING (2)

## CLOCK

### GENERAL

The clock normally displays the Universal Time Coordinated (UTC) from a clock internal time base unit .The time and date are displayed in digital format by two digits for the hours and months, two digits for the minute and days and two digits for the seconds and years. Normally the time is displayed by default. The clock can also display the date. By pushing the SET button when the time is displayed, the date will be displayed. By pushing the SET button again, the time will be displayed again. The UTC selector enables the clock to be synchronized on the GPS signal or INT to run on its internal time base.

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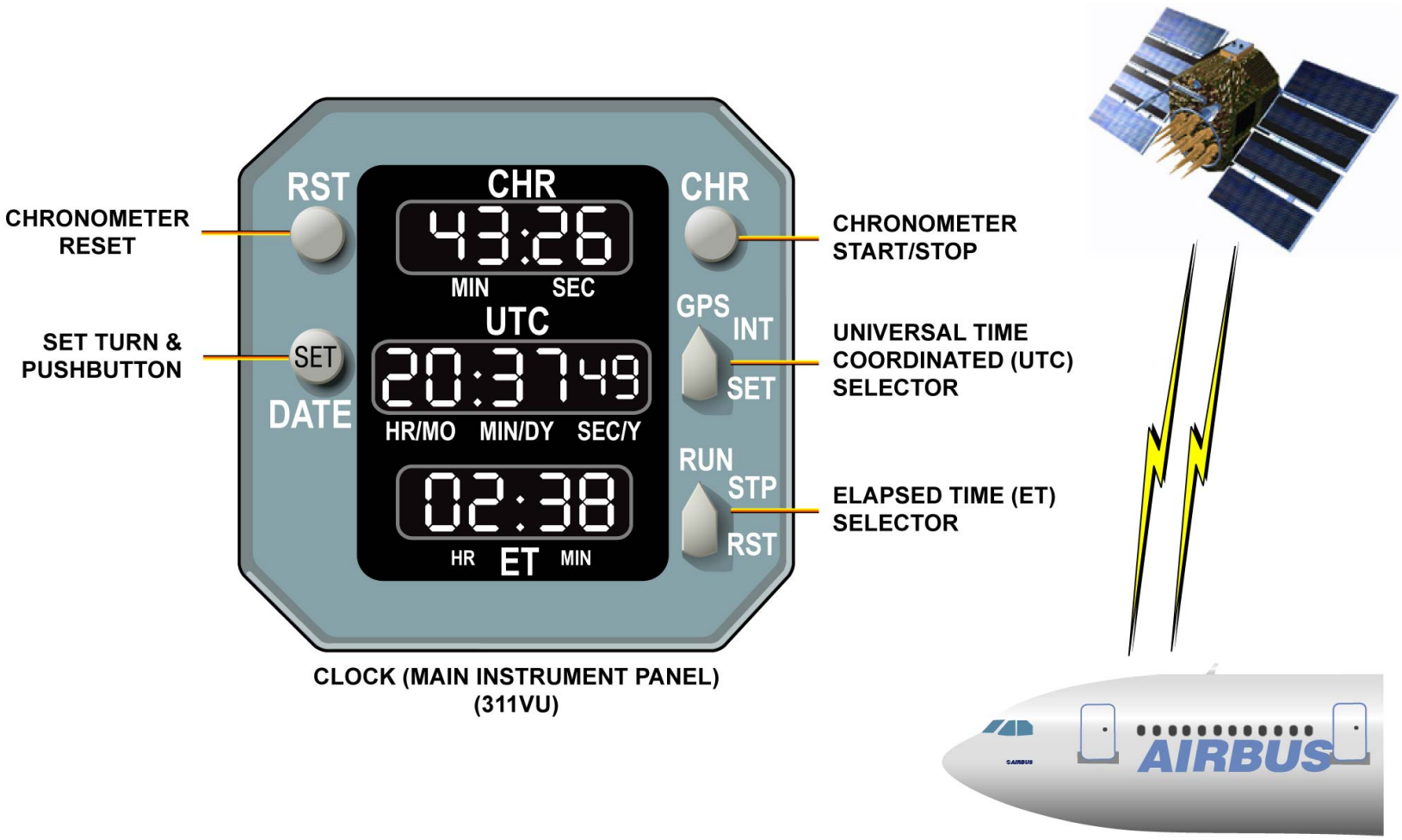


CLOCK (MAIN INSTRUMENT PANEL)
(311VU)

CLOCK - GENERAL

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# INDICATING SYSTEM LINE MAINTENANCE BRIEFING (2)

## CLOCK (continued)

### CLOCK INTERFACES

The electrical clock is located on the main instrument panel. The electrical clock gives UTC via an ARINC 429 format to the:
- Central Maintenance Computer (CMC) for failure message report definition on the MCDU,
- Flight Data Interface and Management Unit (FDIMU) for recording system and monitoring system,
- Flight Management, Guidance and Envelope Computers (FMGECs) for their memory access synchronization,
- Air Traffic Service Unit (ATSU) for the Air Traffic and Information Management System (ATIMS) synchronization with the GPS.

The electrical clock receives information from the Multi-Mode Receiver (MMR), via an ARINC 429 bus, synchronizing it with GPS time from satellite.

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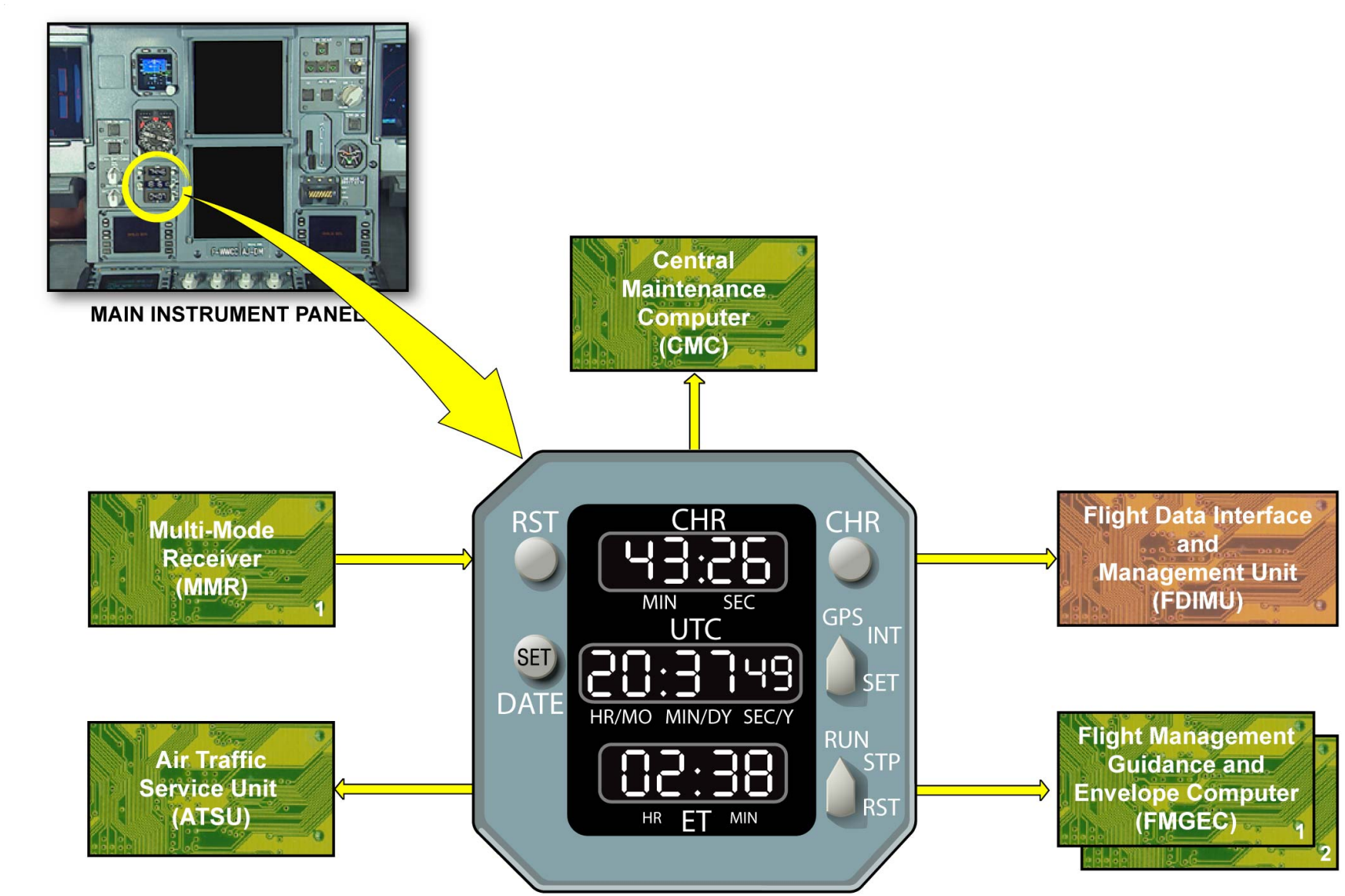


CLOCK - CLOCK INTERFACES

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# INDICATING SYSTEM LINE MAINTENANCE BRIEFING (2)

## CLOCK (continued)

### TIME AND DATE SETTING

The setting of the time is done with the UTC selector. When the selector is in SET position, the second digits are blanked, the minute digits flash and the hour digits are frozen. By rotating the SET button clockwise the minutes increase, counterclockwise the minutes decrease. By pushing the SET button, the hours flash, the minutes are frozen and the seconds stay blanked. By rotating the SET button, the hours can be adjusted. When the UTC selector is moved from SET to INT, the clock starts running from the adjusted time with the second digits starting at 00. The date setting is possible just after setting the time while the UTC selector is still in SET position. After the hours are set, the SET button must be pushed again. Then, the date is displayed, the year digits flash and the month and day digits are frozen. The years can be modified to obtain the chosen value, by rotating the SET button clockwise or counterclockwise. By pushing again the SET button, the months and days can be adjusted in the same way. When the UTC selector is in GPS position, the clock is synchronized with the GPS time, if a GPS signal is shown. If the signal from the GPS fails, the clock internal time base takes over.

### ET FUNCTION

The Elapsed Time (ET) is displayed in digital format by two digits for the hours and two digits for the minutes. It can run up to 99 hours and 59 minutes. The ET selector must be set to the RUN position to activate the ET function. When set to STP, the ET counter stops, and the display is frozen. To reset the display, the selector must be set to RST (spring loaded position) and it returns to STP.

### CHR FUNCTION

The CHRonometer information is displayed in digital format by two digits for the minutes and two digits for the seconds. The CHR is controlled using the CHR P/B, and reset is possible with the RST pushbutton. A first press on it starts the CHR and a second press stops it and freezes the display. A press on the RST P/B resets the chronometer.

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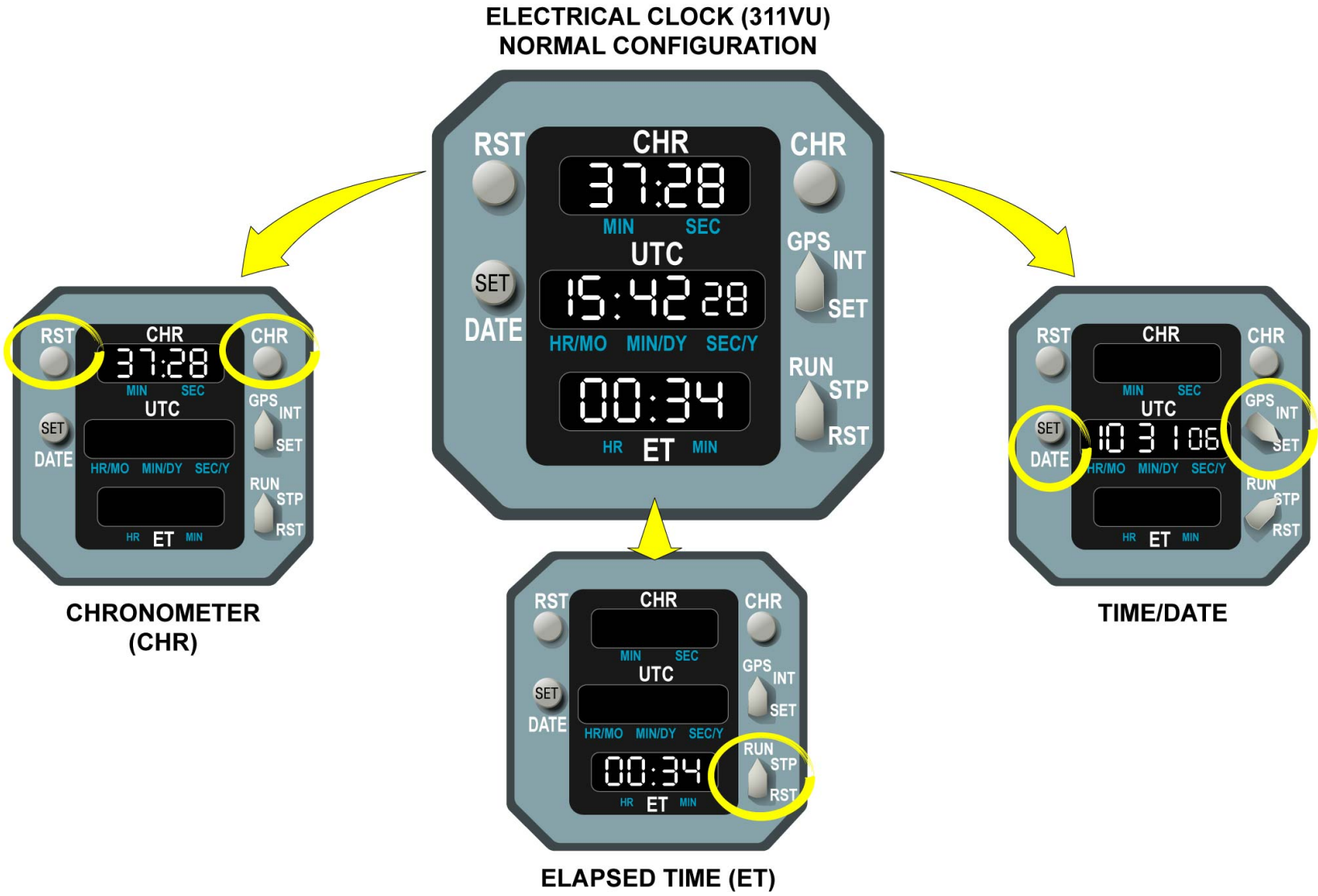


CLOCK - TIME AND DATE SETTING ... CHR FUNCTION

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# INDICATING SYSTEM LINE MAINTENANCE BRIEFING (2)

## CLOCK (continued)

### DISPLAY TEST AND FAILURE CASE

The ANNunciator LighT switch is located on the overhead panel. On the TEST position, the ANN LT switch tests all the segments of the digits on the clock display. All the displays should show eight.

### POWER SUPPLY

When a loss of main electrical power supply occurs, all the clock displays are blanked. Time is still functional in memory via the aircraft battery power supply. When the main electrical power supply is restored, the displays indicate the updated data. In case of a loss of main electrical and aircraft battery power supplies, the time function is no longer available. When the power supply is restored, the time must be reset. With a clock failure the displays are no longer available.

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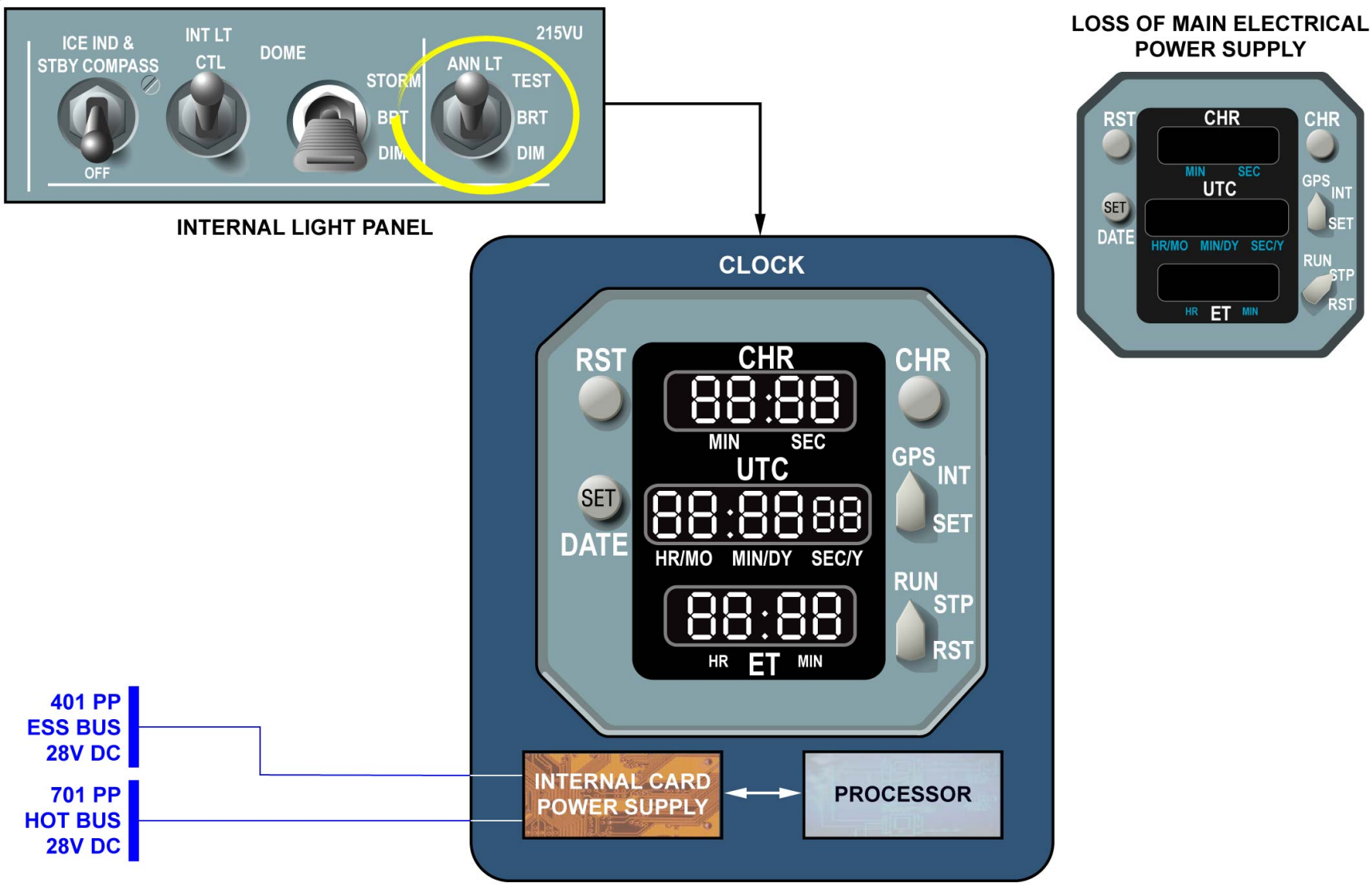


CLOCK - DISPLAY TEST AND FAILURE CASE & POWER SUPPLY

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# INDICATING SYSTEM LINE MAINTENANCE BRIEFING (2)

## CLOCK (continued)

### MAINTENANCE TIPS

CHECK DATA BASE CYCLE is normally displayed on the MCDU scratchpad line if the aircraft current date does not mach the effective date of the active navigation database, and someone attempts to enter a city pair (FROM/TO) or company route (CO RTE). CLOCK/GPS TIME DIFF XX is displayed on the MCDU scratchpad line if Aircraft clock time and GPS time differs by more than XX minutes. Note that these two MCDU messages can also be displayed due to a wrong date setting on the clock. Both FLAP TIP BRK FAULT and SLAT TIP BRK FAULT, ECAM warning messages, are normally displayed in case of FLAP/SLAT tip brake failures. These messages could appear if the automatic Wing Tip Brake (WTB) engagement test is not done or if it is unsuccessful for 10 consecutive days (Ref. to AMM ATA 27 51 00 and 27 81 00). Note that these ECAM messages can also be displayed due to a wrong date setting on the clock. The procedure to correctly set the clock is given by the following AMM task: ATA 31 21 00 750 801.

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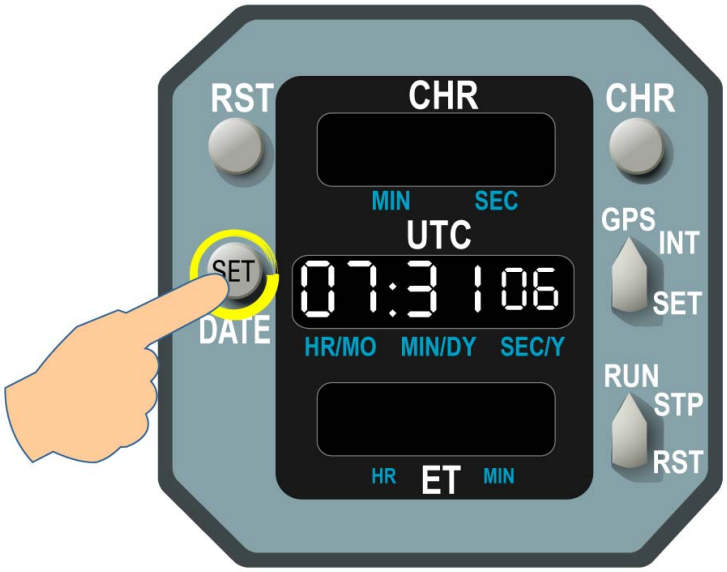
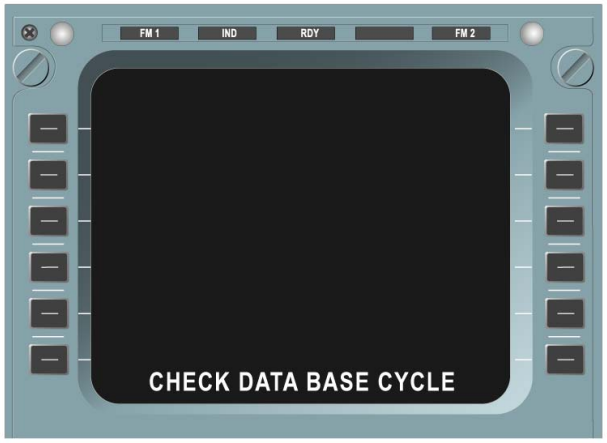
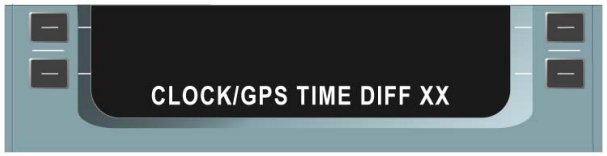



(311VU)

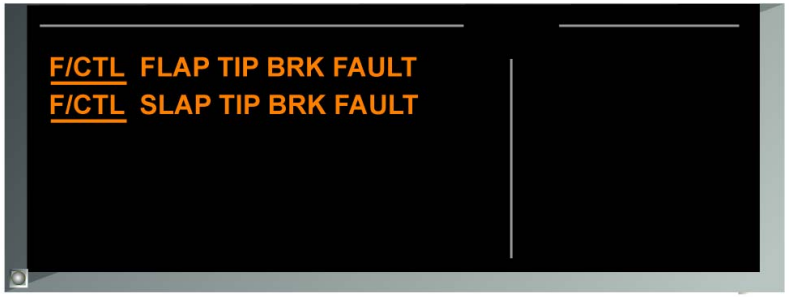
Wrong time and date settings can lead to a delayed aircraft dispatch.

MCDU




ENGINE/WARNING DISPLAY (EWD)




CLOCK - MAINTENANCE TIPS

# EIS GENERAL DESCRIPTION (3)

## GENERAL

The Electronic Instrument System (EIS) presents data to the pilots on six identical and interchangeable Liquid Crystal Display (LCD) units.
This EIS is divided into 2 parts:
- the Electronic Flight Instrument System (EFIS) composed of: 2 Primary Flight Displays (PFDs), and 2 Navigation Displays (NDs).
- the Electronic Centralized Aircraft Monitoring (ECAM) composed of: an Engine/Warning Display (EWD), a System Display (SD) and attention getters.

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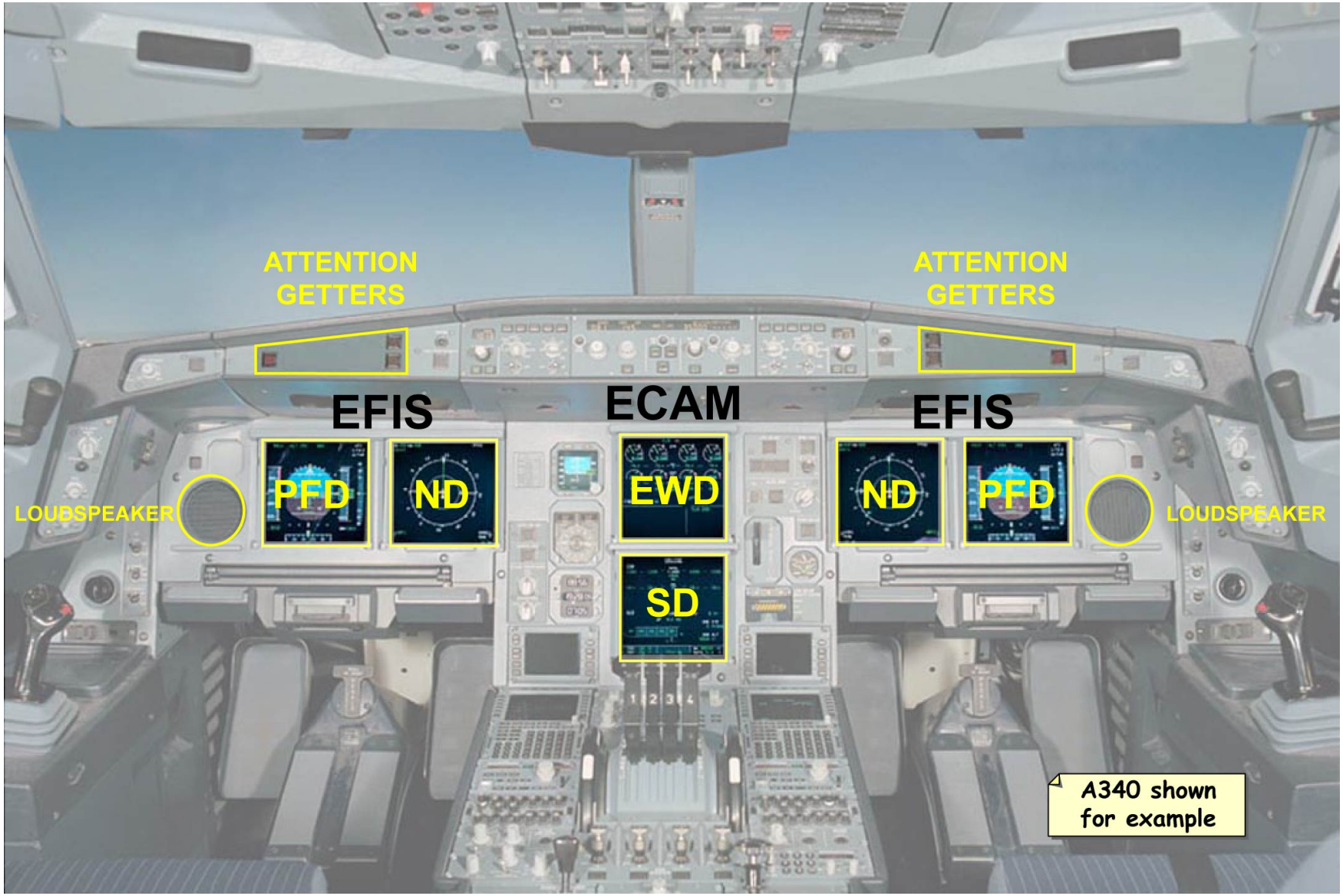
ATTENTION GETTERS
ATTENTION GETTERS
EFIS
ECAM
EFIS
LOUDSPEAKER
PFD
ND
EWD
SD
ND
PFD
LOUDSPEAKER
A340 shown for example

GENERAL

# EIS GENERAL DESCRIPTION (3)

## EFIS

The EFIS information is presented in front of each pilot on a PFD and a ND. The PFD displays the basic flight information required for short-term flight. The ND displays the flight information required for navigation. For each pilot, an EFIS control panel is used for the selection of the displayed modes. An EFIS switching panel for each pilot is used for reconfiguration purposes.

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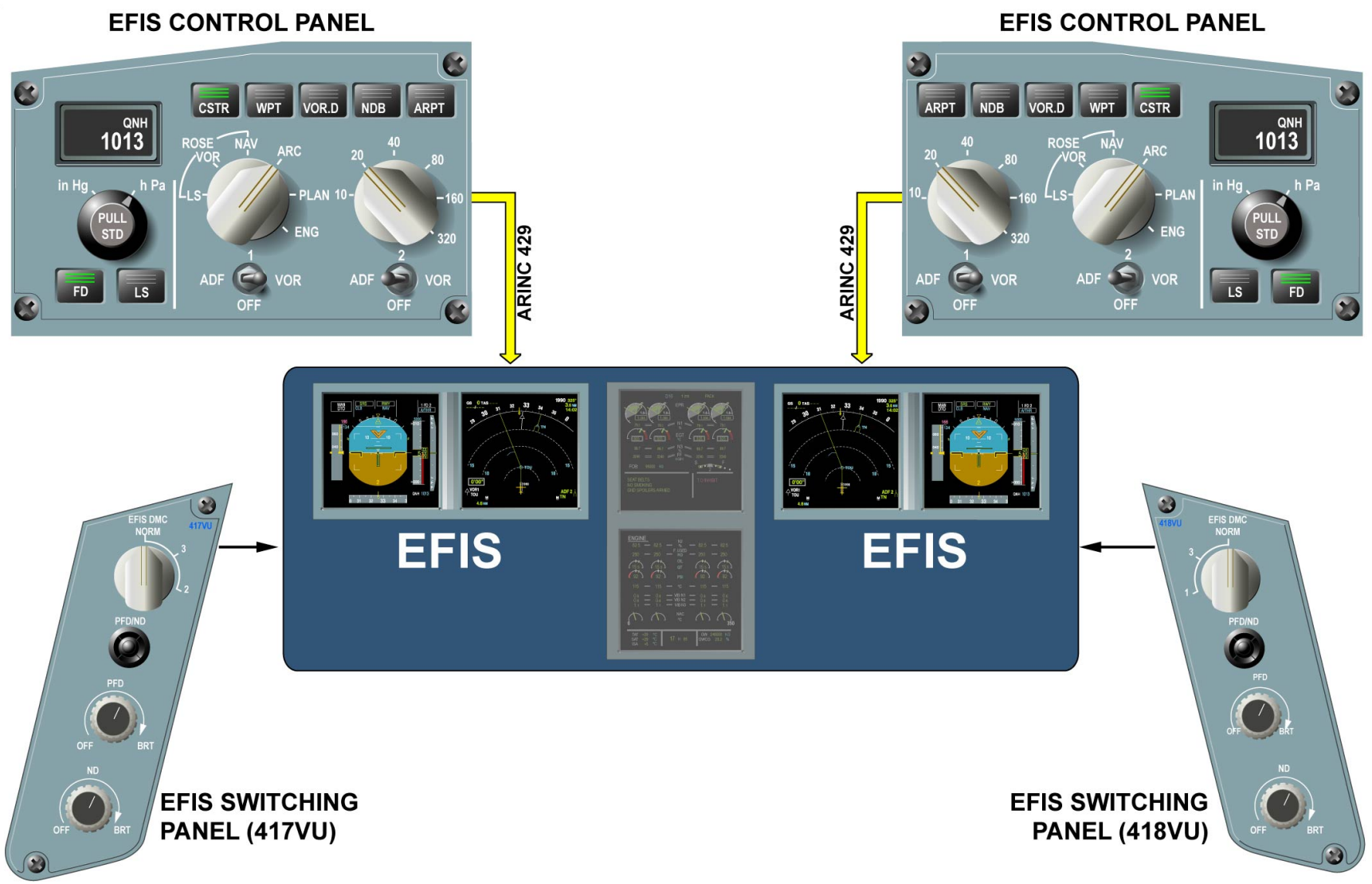
EFIS CONTROL PANEL
EFIS CONTROL PANEL
CSTR
WPT
VOR.D
NDB
ARPT
QNH
1013
ROSE
NAV
ARC
VOR
LS
PLAN
ENG
in Hg
h Pa
PULL
STD
FD
LS
ADF
VOR
OFF
ARINC 429
ARINC 429
EFIS
EFIS
EFIS DMC
NORM
417VU
418VU
PFD/ND
PFD
ND
BRT
EFIS SWITCHING
PANEL (417VU)
EFIS SWITCHING
PANEL (418VU)

EFIS

# EIS GENERAL DESCRIPTION (3)

## EFIS (continued)

### PFD PRESENTATION AND CONTROL

The PFD is divided into several zones. The ATTITUDE and GUIDANCE area presents the aircraft symbols for pitch and roll angle indications, flight path and the drift angle. Heading marks are displayed just under the horizon line if the pitch angle, roll angle and heading information is valid. It also displays the guidance symbols (FD bars), via the FD P/BSW on the EFIS control panel. If the FD is off, a selected heading (or track) cyan symbol is displayed on the horizon line.

The AIRSPEED scale presents speed information plus significant limits such as, protections/targets. The MACH number can also be presented. The HEADING scale presents the aircraft heading and track. The VERTICAL SPEED scale presents the aircraft descent or climb rate. The ALTITUDE scale presents the altitude according to the baro reference setting on the EFIS control panel. The TRAJECTORY DEVIATION presents the lateral and vertical deviation of the aircraft in approach phase as well as the ILS/DME station characteristics by pressing in the LS P/BSW on the EFIS control panel. The FLIGHT MODE ANNUNCIATOR (FMA) provides the pilot with the various active or armed Auto Flight System (AFS) modes.

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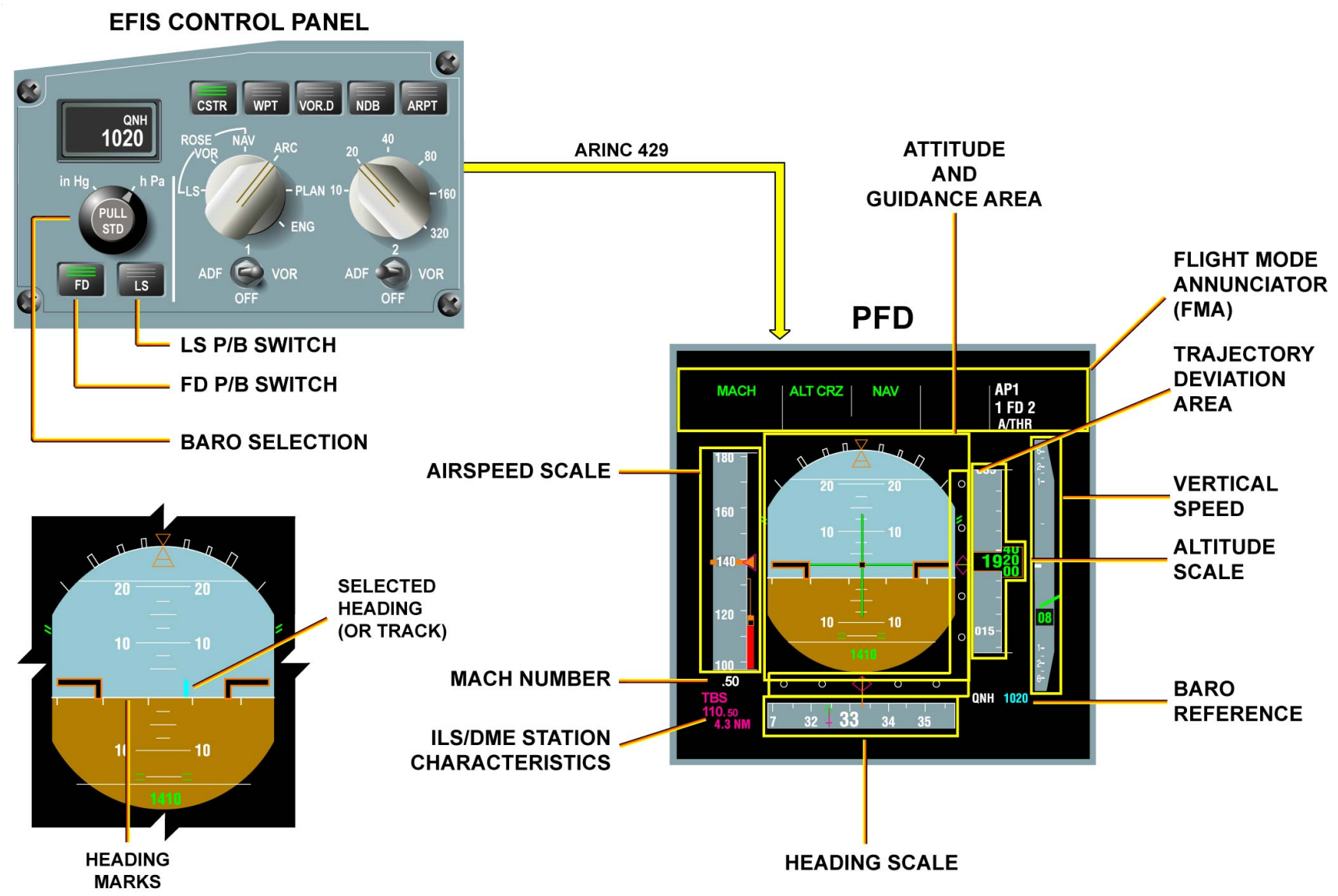


EFIS - PFD PRESENTATION AND CONTROL

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# EIS GENERAL DESCRIPTION (3)

## EFIS (continued)

### ND PRESENTATION AND CONTROL

The ND presents navigation information with 5 different modes selectable by the crew on the EFIS control panel. An ENGINE STANDBY mode is also available. These different selectable modes are:

- ROSE ILS,
- ROSE VOR,
- ROSE NAV,
- ARC,
- PLAN,
- ENG.

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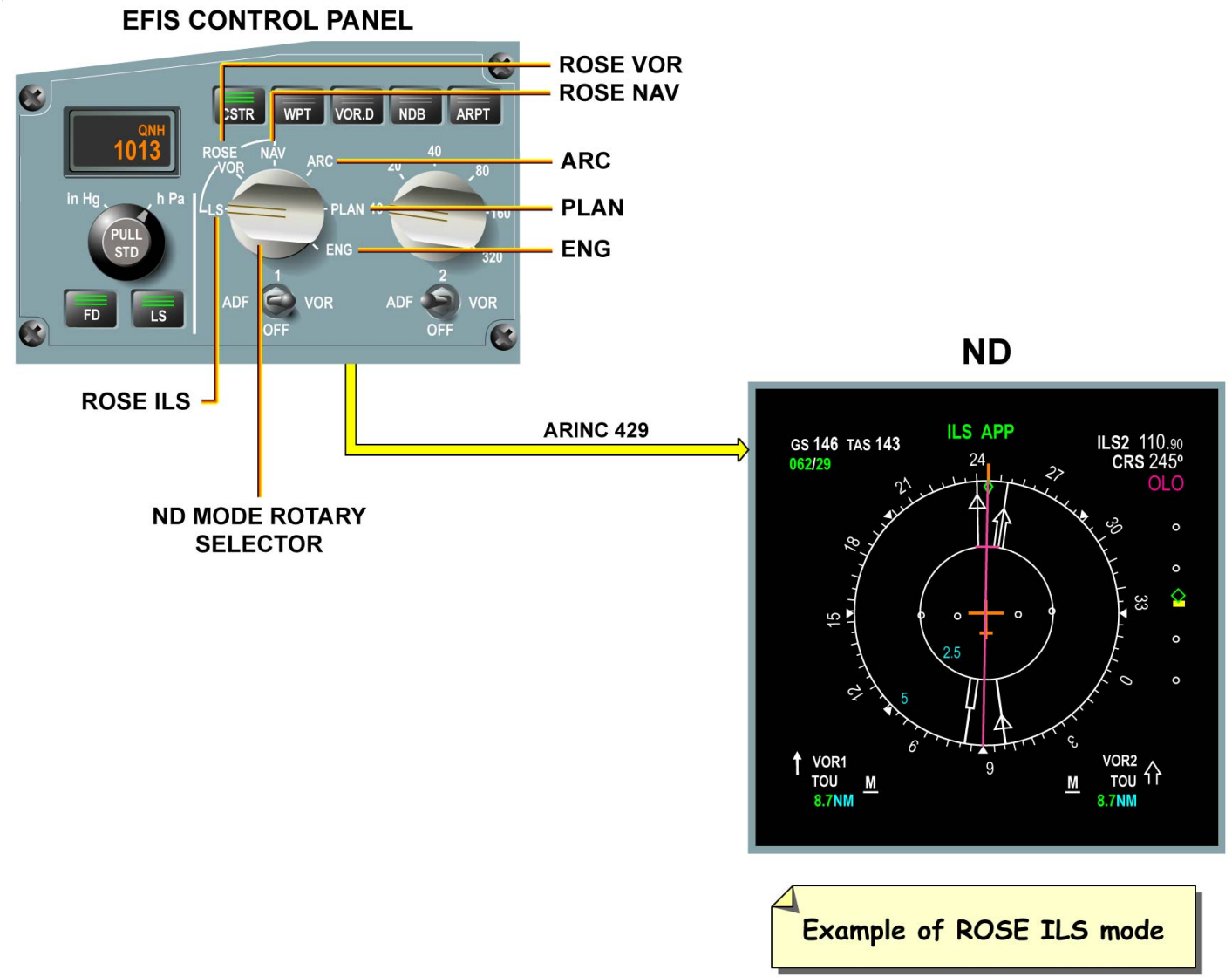


Example of ROSE ILS mode

EFIS - ND PRESENTATION AND CONTROL

# EIS GENERAL DESCRIPTION (3)

## ECAM

The ECAM information is presented on the center instrument panel on an EWD and a SD. The EWD displays engine parameters, Fuel On Board (FOB), slat and flap position, warnings and memo messages. The SD displays synoptic giving the configuration of various aircraft systems. The ECAM controls are provided by the ECAM Control Panel (ECP) for display and by the ECAM switching panel for reconfiguration. The pilot's attention is drawn by:
- 2 MASTER CAUTion, 2 MASTER WARNing, and 2 AUTOLAND warning lights.
- audio signals and auto call out (synthetic voices) are broadcast by 2 loudspeakers.

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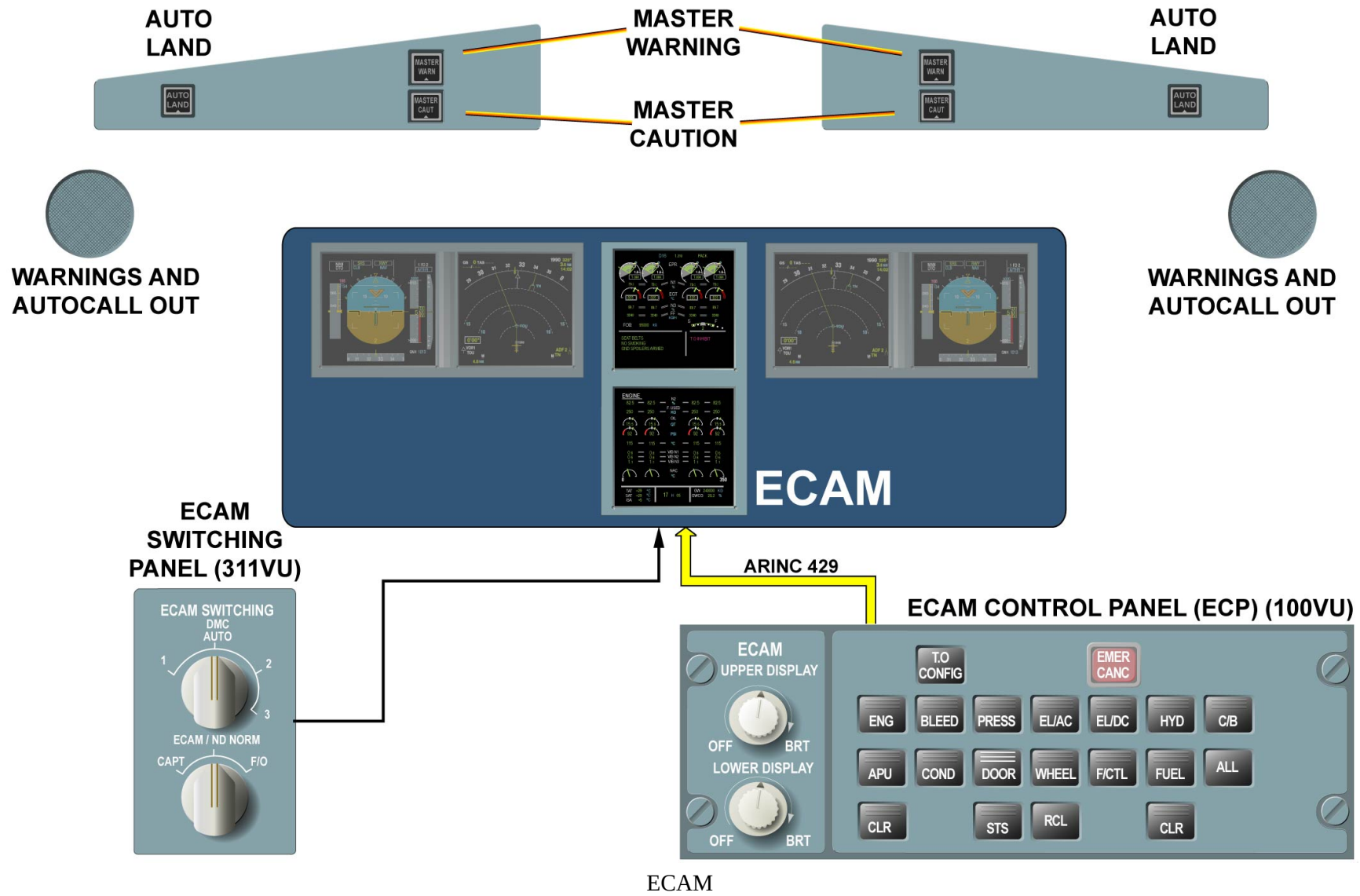


ECAM

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# EIS GENERAL DESCRIPTION (3)

## ECAM (continued)

### EWD PRESENTATION AND CONTROL

The EWD, also called upper ECAM display, is divided into 2 areas.
The upper area displays primary parameters:
- engine primary parameters,
- FOB (Fuel On Board),
- slats/flaps position.

The lower area displays:
- warning and caution messages
- secondary failures and memo messages.

The ECP enables the pilot to switch on and off the EWD, control the brightness and control the ECAM operation.

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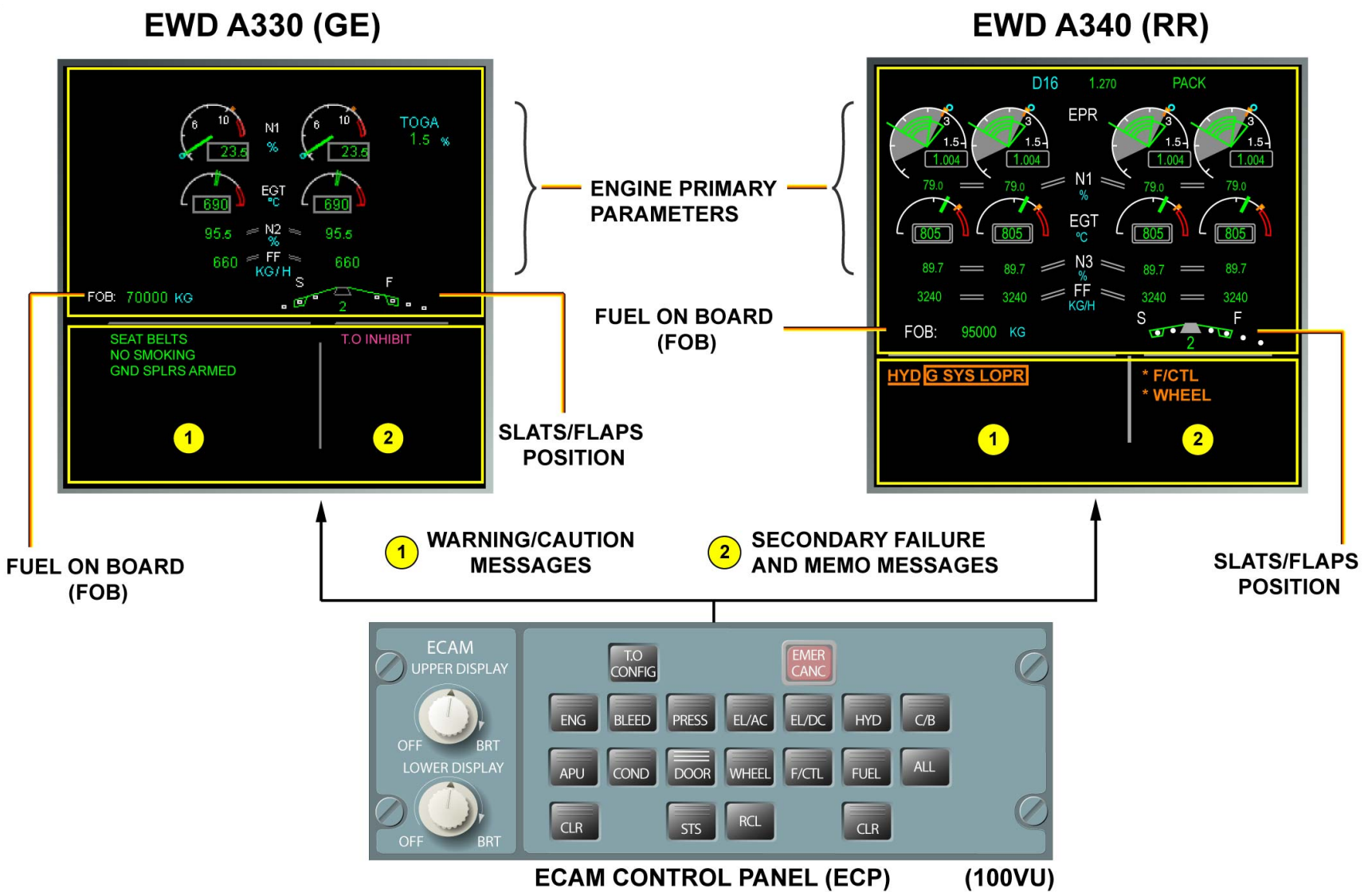


ECAM - EWD PRESENTATION AND CONTROL

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# EIS GENERAL DESCRIPTION (3)

## ECAM (continued)

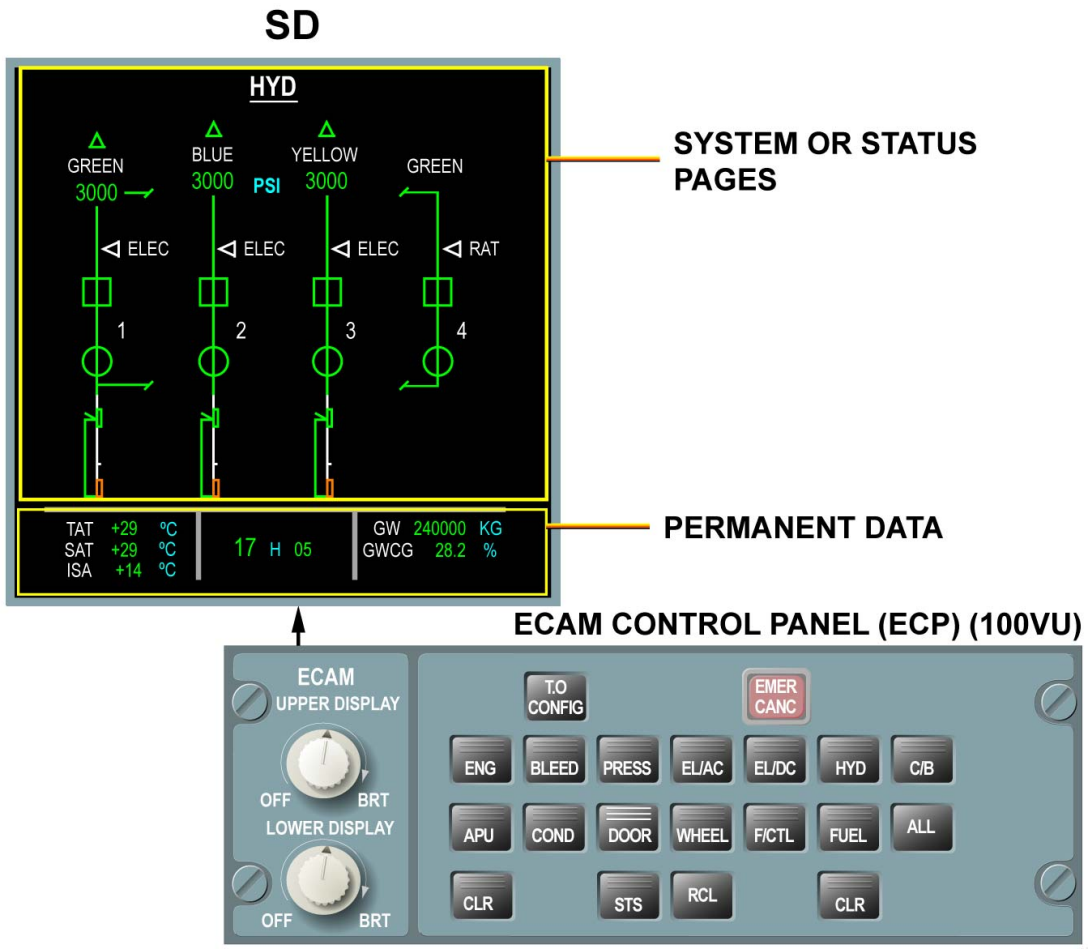
### SD PRESENTATION AND CONTROL

The SD, also called lower ECAM display, is divided into two areas.
The upper area displays system or status pages, which are called automatically or manually through the ECP.
The lower area displays the permanent data:
- Total Air Temperature (TAT),
- Static Air Temperature (SAT),
- Delta International Standard Atmosphere (ISA),
- Gross Weight (GW),
- Center of Gravity (GWCG) and,
- Universal Coordinated Time (UTC).

NOTE: The delta ISA indication is only displayed when the standard altitude mode is selected on CAPT side.

G9409341 - GAUT0T0 - FM31DB000000001

A340 shown for example




ECAM - SD PRESENTATION AND CONTROL

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# EIS GENERAL DESCRIPTION (3)

## EIS ARCHITECTURE

The EIS is an avionics system connected to most of the aircraft systems to fulfill the EFIS and ECAM functions. The EIS comprises 7 computers:
- 3 identical and interchangeable Display Management Computers (DMCs),
- 2 identical and interchangeable Flight Warning Computers (FWCs),
- 2 identical and interchangeable System Data Acquisition Concentrators (SDACs).

It also comprises 6 LCD units. The LCD units have the capability to compute and generate the symbols to be displayed from data, sent by the DMCs. On A340-500 (Option) and A340-600 aircrafts, it is also possible to display video image.

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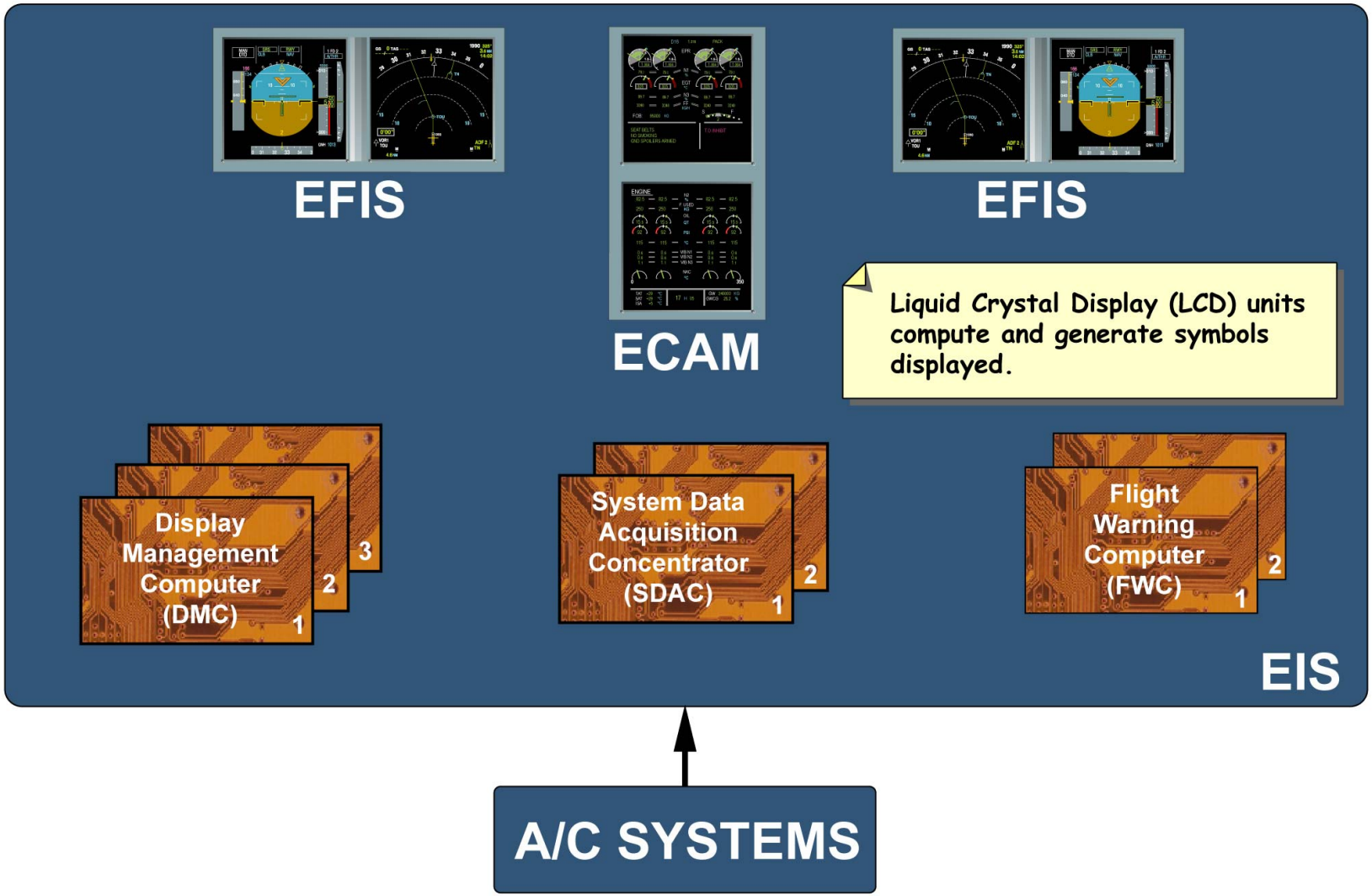
EFIS
ECAM
EFIS
Liquid Crystal Display (LCD) units compute and generate symbols displayed.
Display Management Computer (DMC) 1 2 3
System Data Acquisition Concentrator (SDAC) 1 2
Flight Warning Computer (FWC) 1 2
EIS
A/C SYSTEMS

EIS ARCHITECTURE

# EIS GENERAL DESCRIPTION (3)

## EIS ARCHITECTURE (continued)

### EFIS

The 3 DMCs can be considered as data concentrators. Throughout a flight, the DMCs collect and process aircraft system data necessary for the aircraft handling operation and navigation. These data are sent to the crew respectively on the PFD and ND. The PFD presents short term data and the ND presents long term data. The DMC 1 normally drives the CAPT PFD and ND. The DMC 2 normally drives the F/O PFD and ND. The DMC 3 is in standby and can be used in case of DMC 1 or/and 2 failure.

The EFIS reconfiguration (DMCs and LCD units) can be achieved either automatically or manually through the EFIS switching panels.

Three main types of reconfiguration are considered for EFIS:

- in case of single or multiple LCD units failure,
- in case of single or multiple DMC failure,
- in case of external computer information source failure.

LCD units also receive weather radar (WXR) signals, Enhanced Ground Proximity Warning System (EGPWS) terrain image and video signals from taxi cameras.

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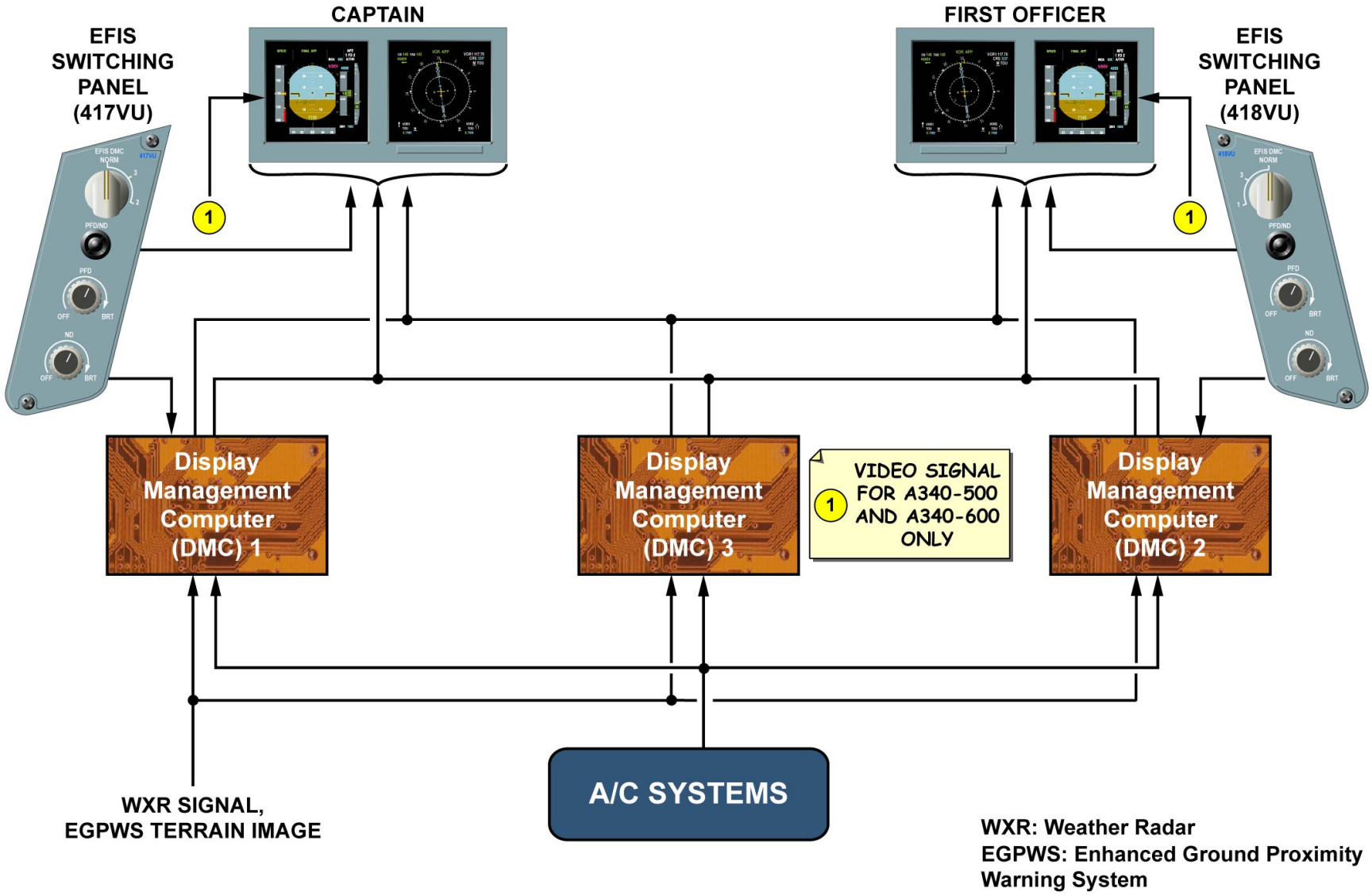


EIS ARCHITECTURE - EFIS

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# EIS GENERAL DESCRIPTION (3)

## EIS ARCHITECTURE (continued)

### ECAM

The ECAM function is achieved by the SDACs and the FWCs. The Flight Warning System (FWS) provides operational assistance during normal and abnormal configurations of the aircraft systems. The ECAM is used for management purposes of these systems. The SDACs fulfill 3 main functions:
- data acquisition from the aircraft systems,
- data concentration,
- data digitizing to be sent to the DMCs for display on the SD.

The DMCs directly receives aircraft systems data for display on the upper part of the EWD. The SDACs receive and digitize aircraft system information concerning amber cautions and transmit it to the FWCs. The FWCs fulfill 3 main functions:
- data acquisition from some main aircraft systems,
- data warning computation (all warnings, memos, status),
- flight phase computation according to the aircraft configuration.

The FWCs directly receive aircraft system data concerning red warnings and generate memos. They generate all warning messages and activate attention getters (MASTER WARN/MASTER CAUT and AUTOLAND) as well as audio signals and auto call outs (synthetic voices) broadcast by two loudspeakers (no volume control for the audio signals). The DMC 3 normally drives the EWD and the SD. The DMC 1 and DMC 2 are in standby and can be used in case of DMC 3 failure.
The ECAM reconfiguration (DMCs and LCD units) can be achieved either automatically or manually through the ECAM switching panel.
The SD also receives a video signal from the taxi cameras system (A340-500/600 only) and Cockpit Door Surveillance System (CDSS).

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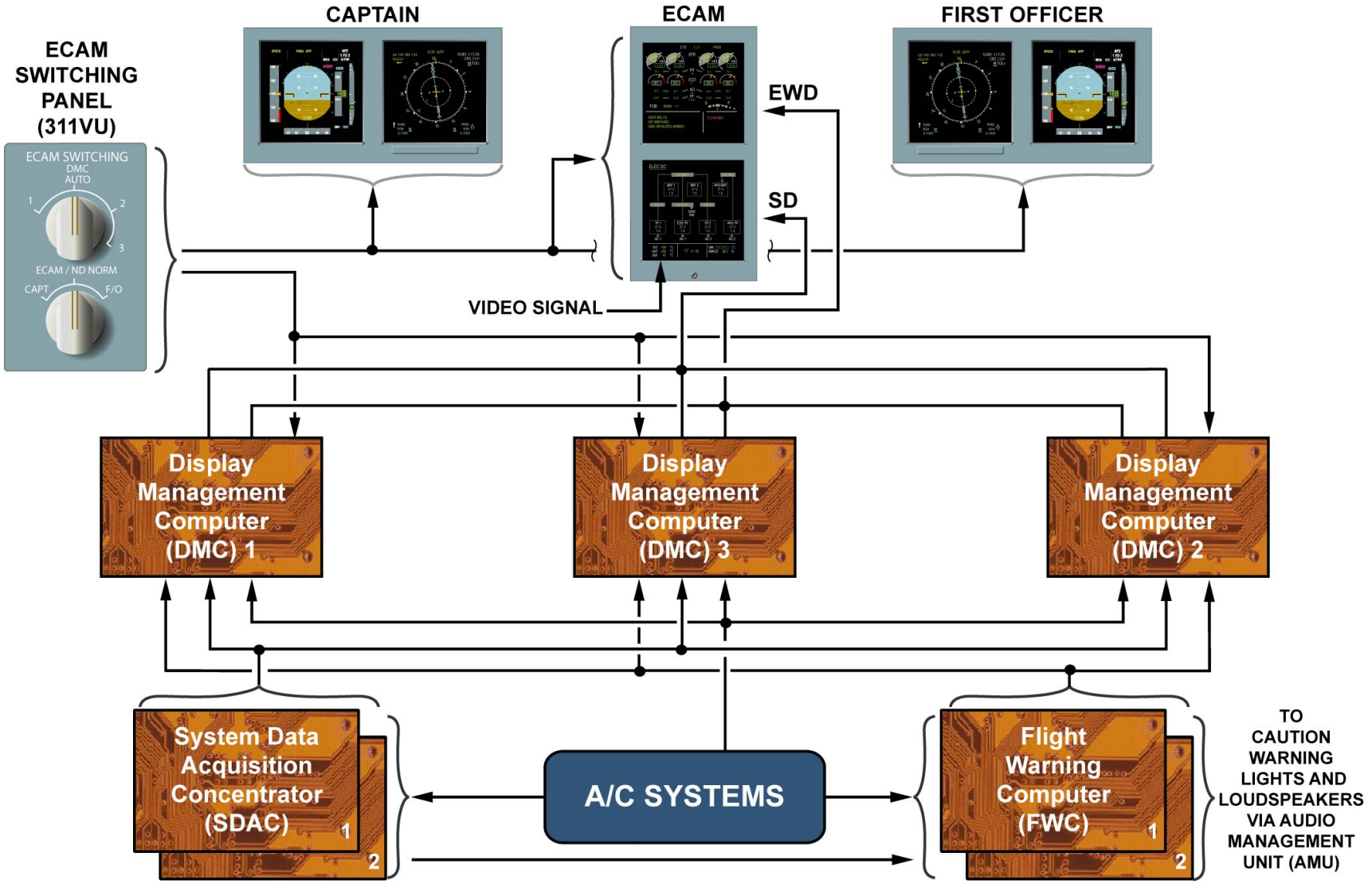


EIS ARCHITECTURE - ECAM

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# EIS GENERAL DESCRIPTION (3)

## REDUNDANCY

A great redundancy between systems is used to minimize the loss of information. The fully redundant architecture of the FWS allows it to be transparent to any single internal failure. With the EIS architecture, a single SDAC failure associated to a single FWC and 2 DMCs failures, it is still possible to display EFIS and ECAM information on the LCD units. In the case of a single SDAC failure associated to a single FWC failure, the ECAM system continues to operate.

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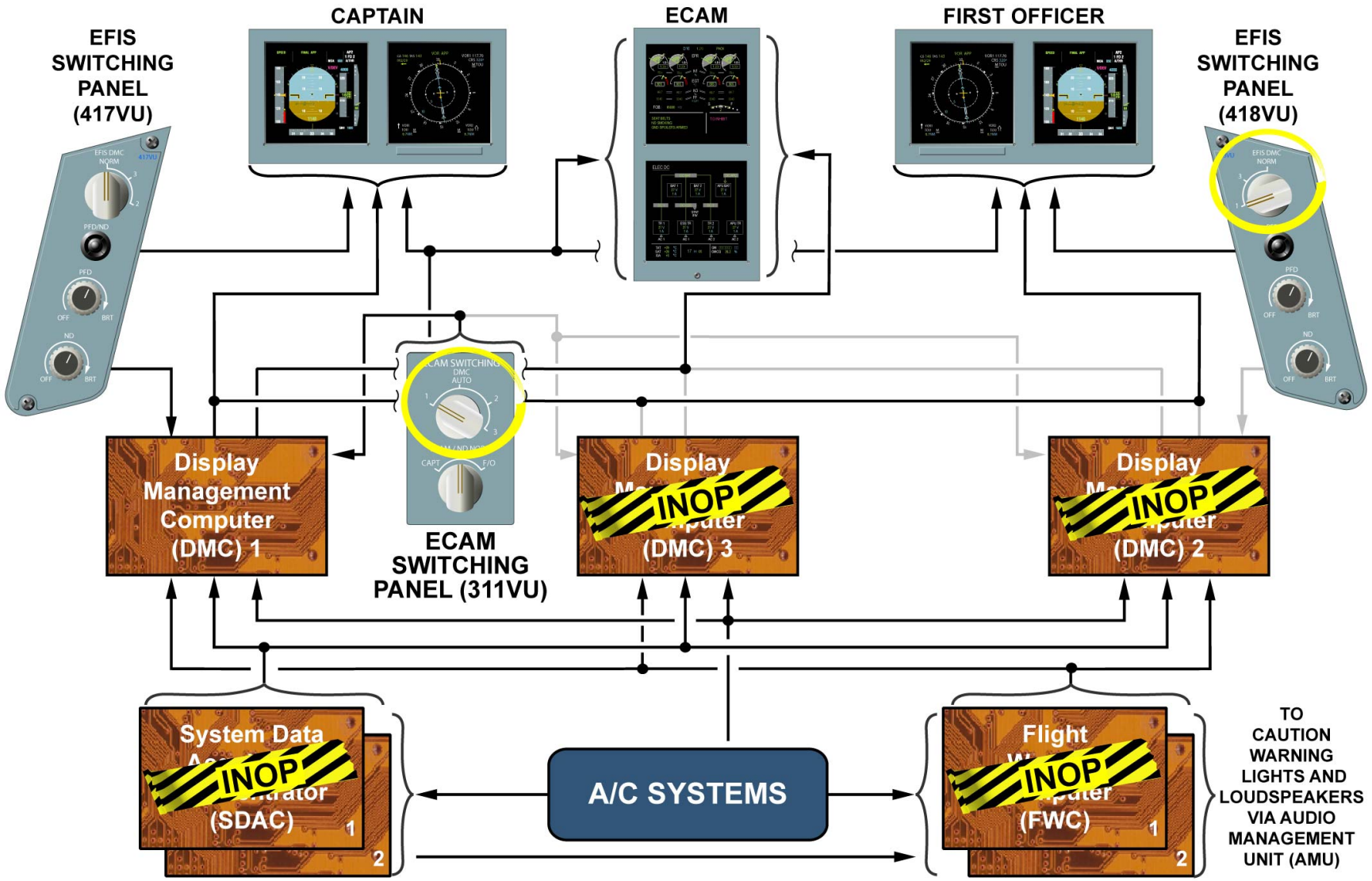

CAPTAIN
ECAM
FIRST OFFICER
EFIS SWITCHING PANEL (417VU)
EFIS SWITCHING PANEL (418VU)
Display Management Computer (DMC) 1
ECAM SWITCHING PANEL (311VU)
Display INOP (DMC) 3
Display INOP (DMC) 2
System Data INOP (SDAC) 1 2
A/C SYSTEMS
Flight INOP (FWC) 1 2
TO CAUTION WARNING LIGHTS AND LOUDSPEAKERS VIA AUDIO MANAGEMENT UNIT (AMU)

REDUNDANCY

G9409341 - GAUT0T0 - FM31DB000000001

# EIS ECAM NORMAL & MANUAL MODE GENERAL DESC. (3)

## GENERAL

The Electronic Centralized Aircraft Monitoring (ECAM) gives to the flight crew the aircraft system displays. The ECAM shows data on two Liquid Crystal Display (LCD) units, the upper ECAM is the Engine/Warning Display (EWD) and the lower ECAM is the System Display (SD). These LCDs are fully interchangeable.

G9409341 - GAUT0T0 - FM31DC000000002

ENGINE/WARNING DISPLAY (EWD)

SYSTEM DISPLAY (SD)

These ECAM pages are shown with an A330, RR Trent engines with metric units. These displays are shown as examples.

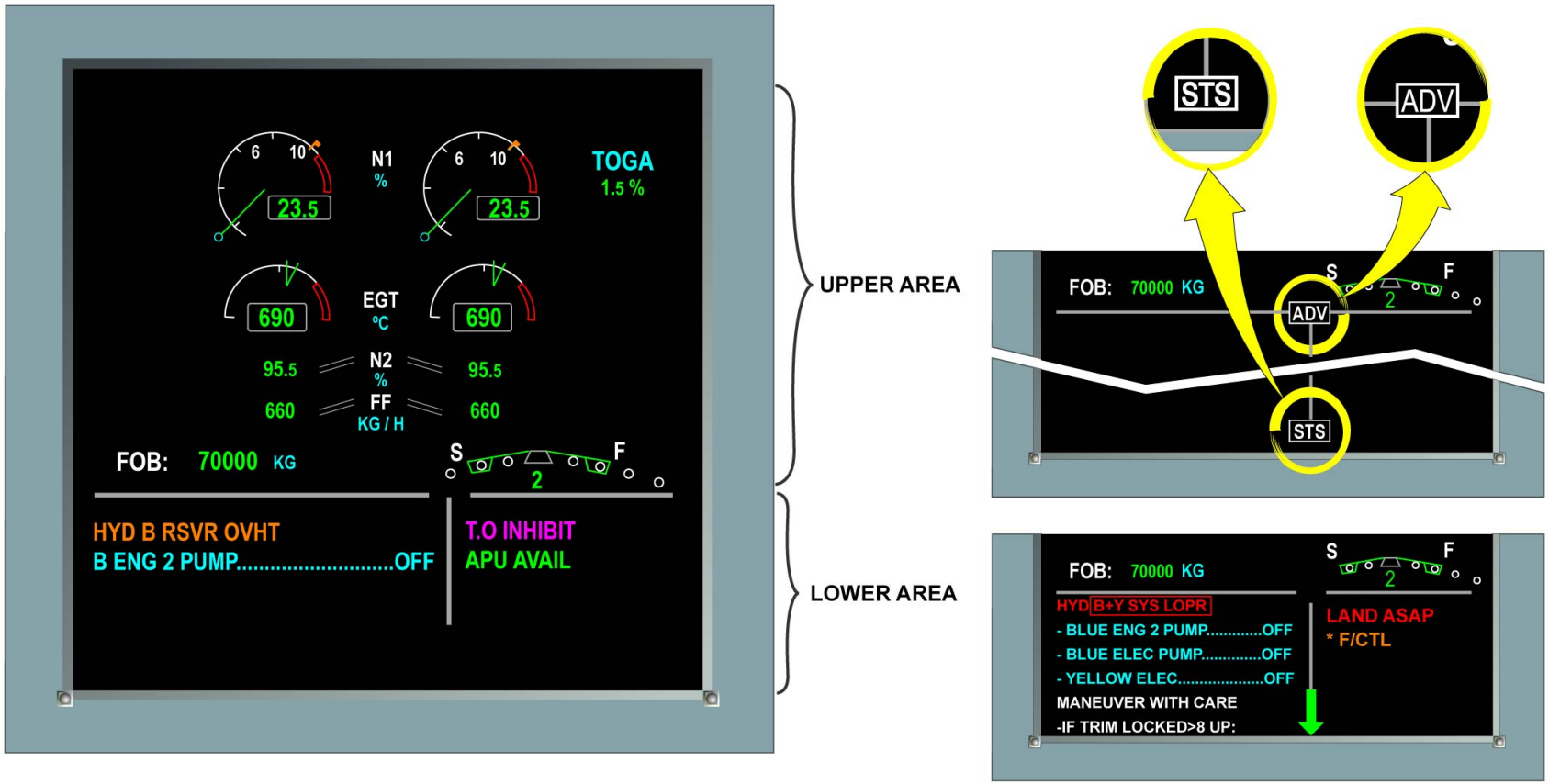
GENERAL

# EIS ECAM NORMAL & MANUAL MODE GENERAL DESC. (3)

## ENGINE/WARNING DISPLAY PRESENTATION

The EWD gives the essential data necessary to monitor engine parameters, warnings, cautions, checklist, and memos to the flight crew. The upper area is related to engine parameters (engine primary, fuel on board and slat/flat position), these are given in analog and/or digital form.
The lower area is dedicated to warning/caution and memo messages. Warnings and memos are automatically generated by the Flight Warning Computer (FWC). The left memo area is dedicated to warnings and cautions (primary or independent failures) or memo information related to procedural pilot actions or memo information. The right memo area is dedicated to the system affected by a warning or a caution (secondary failure) or memo information related to the phase inhibition (takeoff and landing only) or temporary pilot actions (ANTI ICE ON) or special lines (AP OFF).
Status, advisory and overflow are indications on the display.
The advisory (ADV), appears by pulsing in white to indicate that an aircraft system parameter has drifted out of its normal operating range. In ECAM single display mode, the related page pushbutton will also flash on the ECAM Control Panel (ECP) to indicate to the crew which system page is affected by an advisory.
The status (STS) indicates that a status message is on the ECAM status page. The overflow arrow indicates that the warning messages exceed the capacity of the display on the left memo area (7 lines). In this case, the heading titles of the warning messages are displayed on the right memo area.

G9409341 - GAUT0T0 - FM31DC000000002




These ECAM pages are shown with an A330, GE engines with metric units. These displays are shown as examples.

ENGINE/WARNING DISPLAY PRESENTATION

# EIS ECAM NORMAL & MANUAL MODE GENERAL DESC. (3)

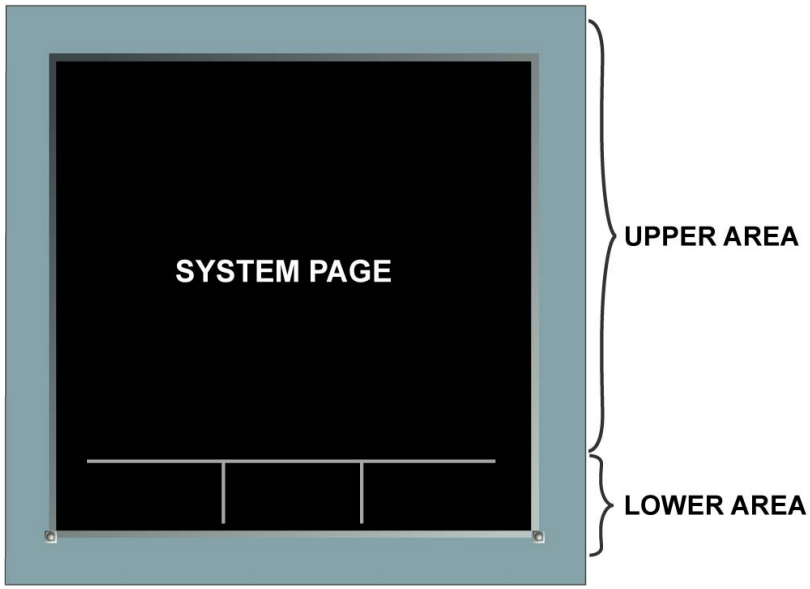
## SYSTEM DISPLAY PRESENTATION

The SD is divided into 2 areas:
- the upper area displays system or status pages,
- the lower area is dedicated to permanent data.

The SD can display one of 13 system pages, cruise page or status page.
In normal operation, the SD automatically shows the system pages according to the current flight phase. Nevertheless manual page selection is always possible. The CRUISE page is automatically displayed in flight (no manual selection). It displays the main system parameters to monitor during the flight.
The status page is an operational summary of the current aircraft condition.
The information is displayed at the end of an ECAM procedure or upon crew request.
The status page includes:
- the limitation, approach procedures, information and cancelled cautions are displayed in the left column,
- the inoperative systems below the caption "INOP SYS" and any class 2 system failure below the caption "MAINTENANCE" are displayed in the right column.

At the bottom of the SD, below the grey line is the permanent data. It is always displayed whatever system page is present.
Total Air Temperature (TAT) and Static Air Temperature (SAT) are digital values. International Standard Atmosphere (ISA) is in fact a delta ISA indication that appears only if the Captain Baro Selector is set to standard barometric reference. The captions (TAT, SAT, ISA, GW, GWCG) are displayed in white and the units in cyan. The values are normally displayed in green. When data sent with the Sign Status Matrix (SSM) bits set to no computed data, amber crosses replace the values.
Load factor (G LOAD) is only displayed amber when the aircraft speed is above 80 kts and if the value is more than +1.4 G or less than -0.7 G for more than 2 seconds. The information remains in view for 5 seconds, when the excessive condition has disappeared. Feedback to the flight crew by providing system messages can also be displayed in amber above or below the time indication. In case of degraded value, last 2 digits are dashed, in case of No Computed Data (NCD), 3 blues dashes replaces the values (on ground).

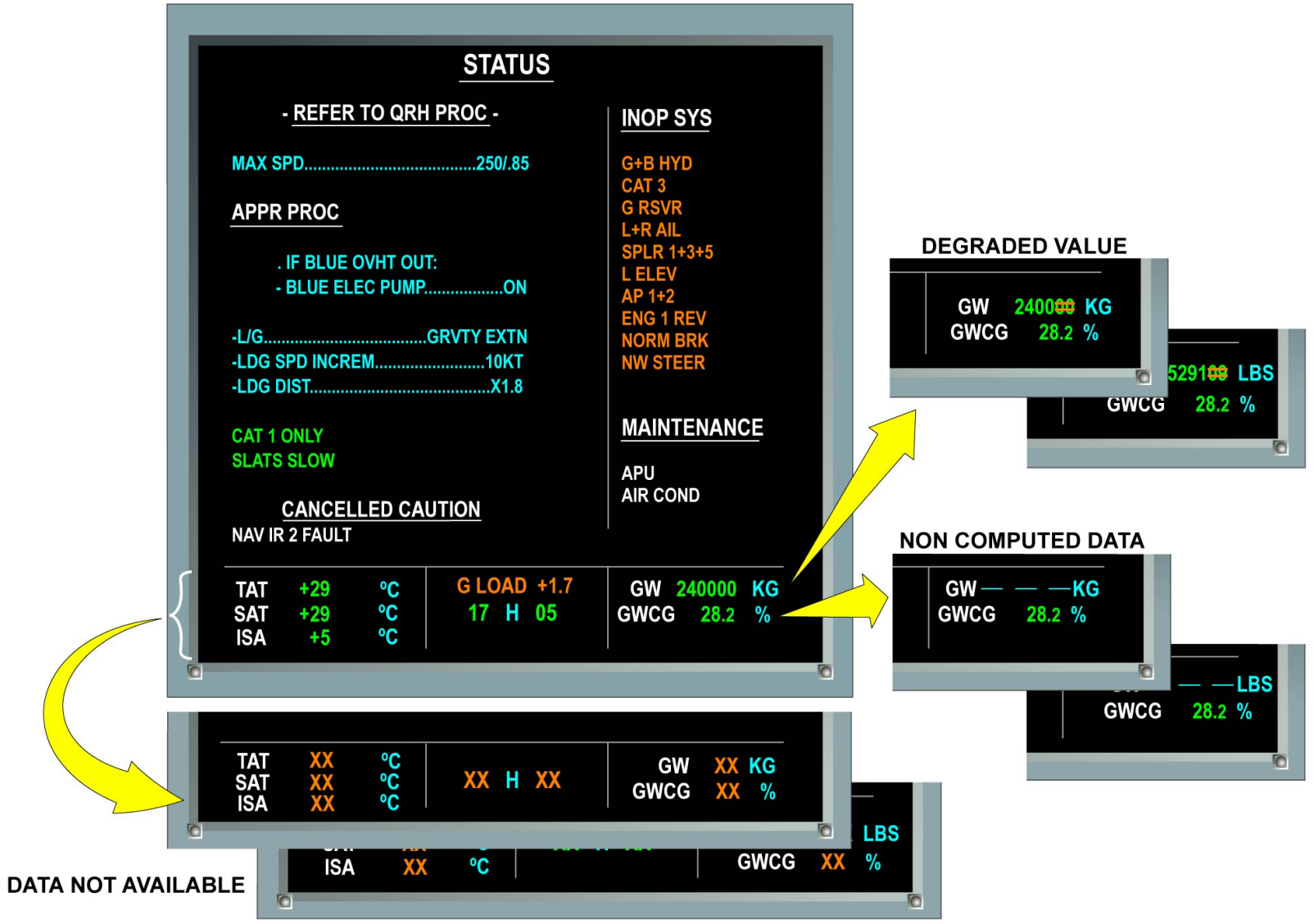
G9409341 - GAUT0T0 - FM31DC000000002




The 13 system pages are:
Air Bleed (BLEED), Air Conditioning (COND),
Cabin Pressurization (CAB PRESS),
Electrical AC Power Supply (ELEC AC),
Electrical DC Power Supply (ELEC DC),
Flight Controls (F/CTL), Fuel (FUEL),
Hydraulic Power (HYD), APU (APU),
Engine Secondary Parameters (ENGINE),
Door and Oxygen (DOOR/OXY),
Landing Gear, Wheels, Brakes (WHEEL),
Circuit Breaker Status (C/B).

The CRUISE page is shown with an A330,
GE engines with metric units.
This display is shown as an example.

SYSTEM DISPLAY PRESENTATION




SYSTEM DISPLAY PRESENTATION

G9409341 - GAUT0T0 - FM31DC000000002

This Page Intentionally Left Blank

G9409341 - GAUT0T0 - FM31DC000000002

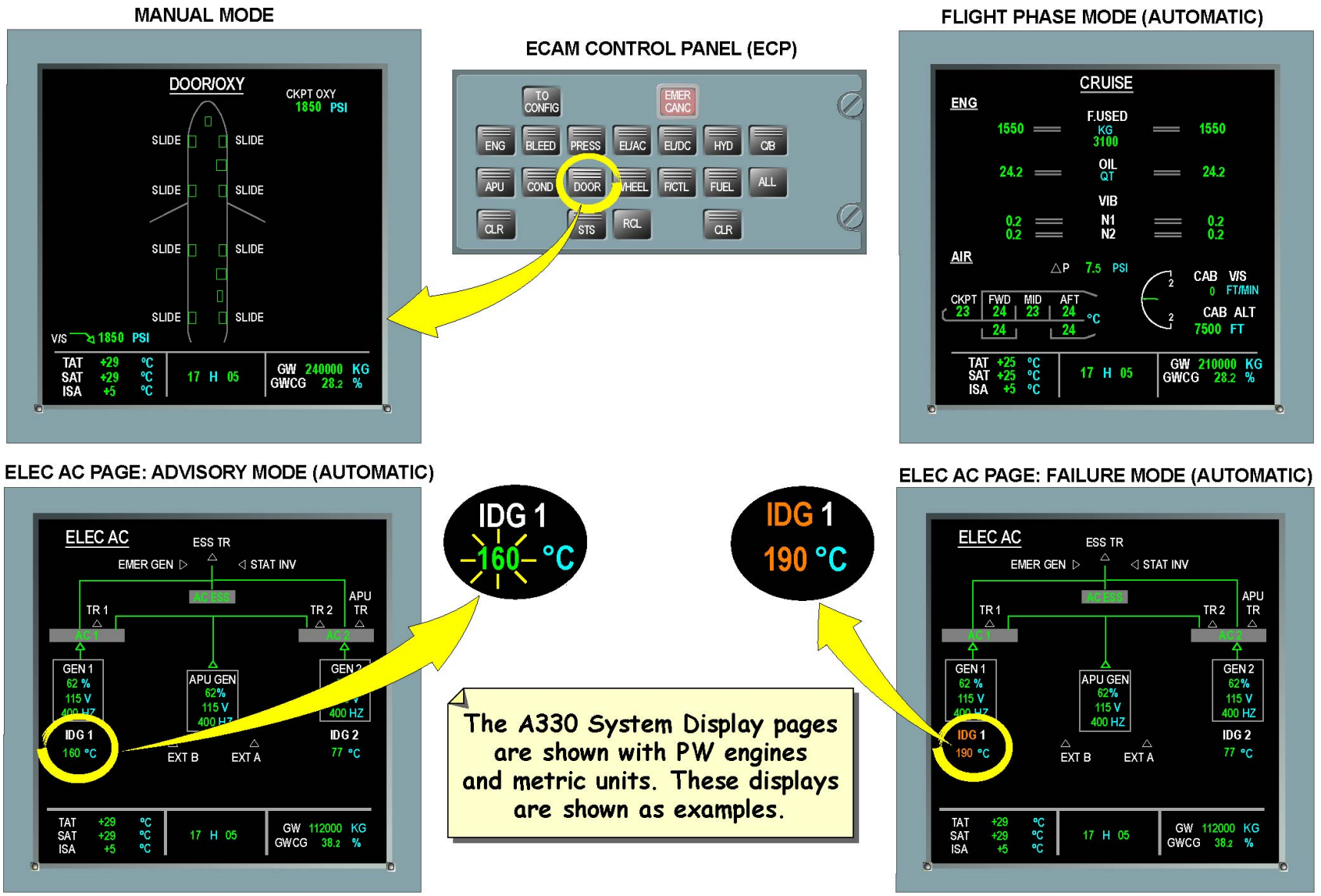
# EIS ECAM NORMAL & MANUAL MODE GENERAL DESC. (3)

## ECAM MODES

The ECAM operates in four modes for the system page presentation with a priority order:
- the normal mode according to the flight phase is automatically presented in case of an aircraft configuration change,
- the failure mode is automatically presented when warning/caution is triggered,
- the advisory mode is automatically presented when a parameter is drifting,
- the manual mode, through the ECP.

NOTE: Note that the manual mode is cancelled in case of a warning or an advisory.

G9409341 - GAUT0T0 - FM31DC000000002




ECAM MODES

G9409341 - GAUT0T0 - FM31DC000000002

# EIS ECAM NORMAL & MANUAL MODE GENERAL DESC. (3)

## ECAM MODES (continued)

### NORMAL MODE

In normal operation the ECAM system pages are displayed according to the current flight phase, this mode is called automatic mode. A flight is divided into 10 phases corresponding to an aircraft configuration change. These flight phases are generated by the FWC and used by the Display Units (DUs) to automatically call up the system pages.

DOOR (phase 1)

The APU or engine pages are displayed in priority if the APU or the engines are started, in any flight phase.
The APU page appears when APU master switch is switched ON. It disappears when APU master switch is switched OFF or the APU RPM is above 95% for 10 seconds.
The DOOR page reappears 10 seconds after the APU is available.

WHEEL (phase 2)

The WHEEL page is displayed only after the engine start has been completed, and the Engine Start switch is returned to the Normal position.
The FLighT ConTroL page replaces the WHEEL page for 20 seconds when either sidestick is moved or when rudder deflection is above 22 degrees.

ENGINE (phase 3,4,5)

During these phases, most warnings are inhibited.
TO INHIBIT is displayed on the right memo area of the EWD.

CRUISE (phase 6)

The CRUISE page appears as soon as the slats are retracted and the engines are not at take off power, provided that the landing gear is retracted. The TO INHIBIT message disappears. The CRUISE page disappears when the landing gear is selected down and ALT below 10000ft.

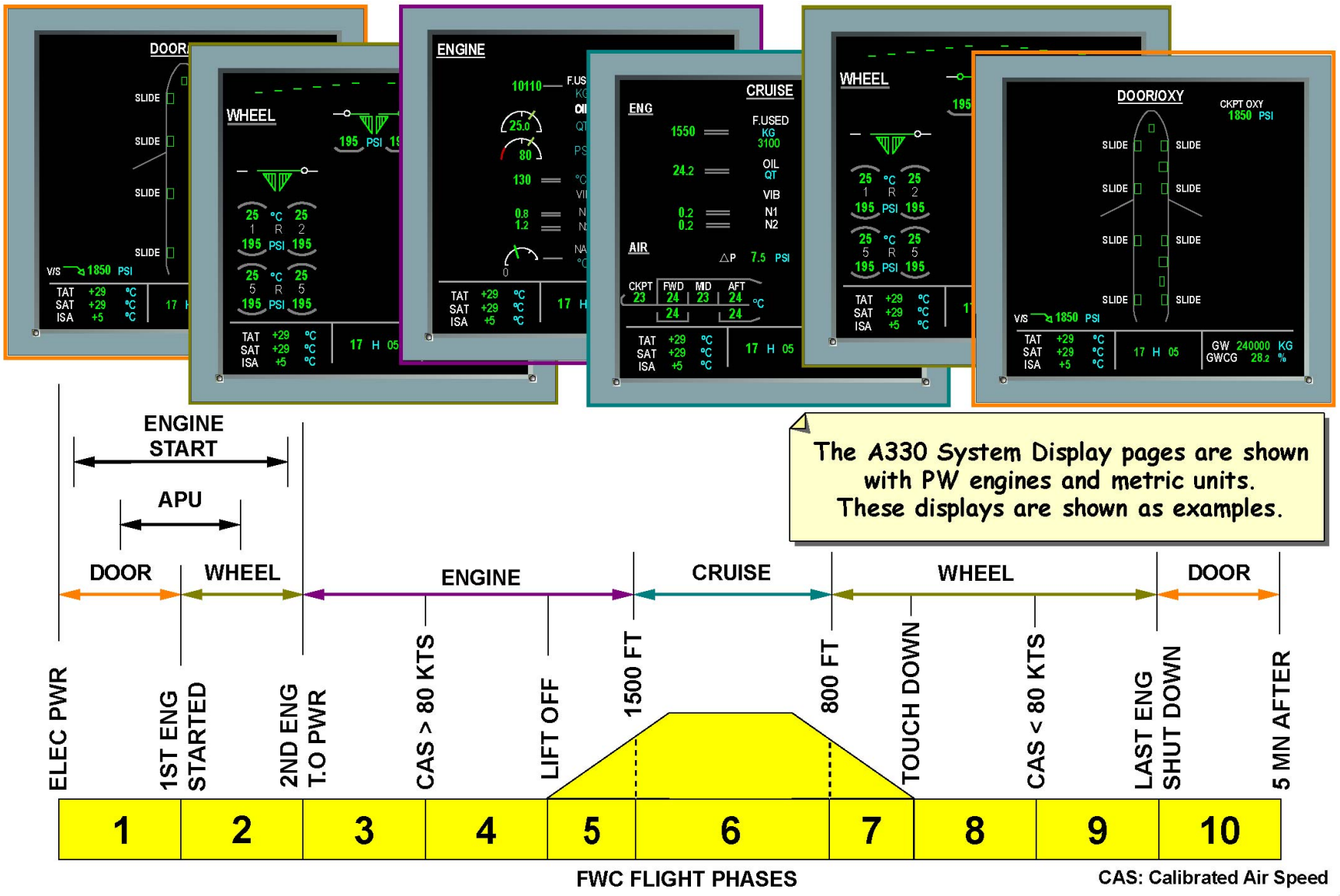
WHEEL (phase 7,8,9)

During these phases, most warnings are inhibited.
"LDG INHIBIT" is displayed on the right memo area of the EWD.
"LDG INHIBIT" message disappears (flight phase 9).

DOOR (phase 10)

Five minutes after the last engine shutdown the FWC starts a new flight leg at phase 1.

G9409341 - GAUT0T0 - FM31DC000000002




ECAM MODES - NORMAL MODE

G9409341 - GAUT0T0 - FM31DC000000002

# EIS ECAM NORMAL & MANUAL MODE GENERAL DESC. (3)

## ECAM MODES (continued)

### MANUAL MODE

When one of the system key is pressed, the corresponding system page is displayed on the SD and the ECP key light comes on. When the key is pressed a second time, the key light extinguishes, and the page corresponding to the flight phase or current warning is displayed again. In the event of an ECAM control panel failure, due to the built in redundancy, the system pages are still available through the ALL key. When the ALL key is pressed and held, all the system pages are displayed successively at one second of intervals. This key, when pressed repeatedly, will enable the display of the next system page.

G9409341 - GAUT0T0 - FM31DC000000002

ECAM CONTROL PANEL (ECP) (100VU)

SYSTEM DISPLAY (SD)

The DOOR/OXY page is shown with metric units.
This display is shown as an example.

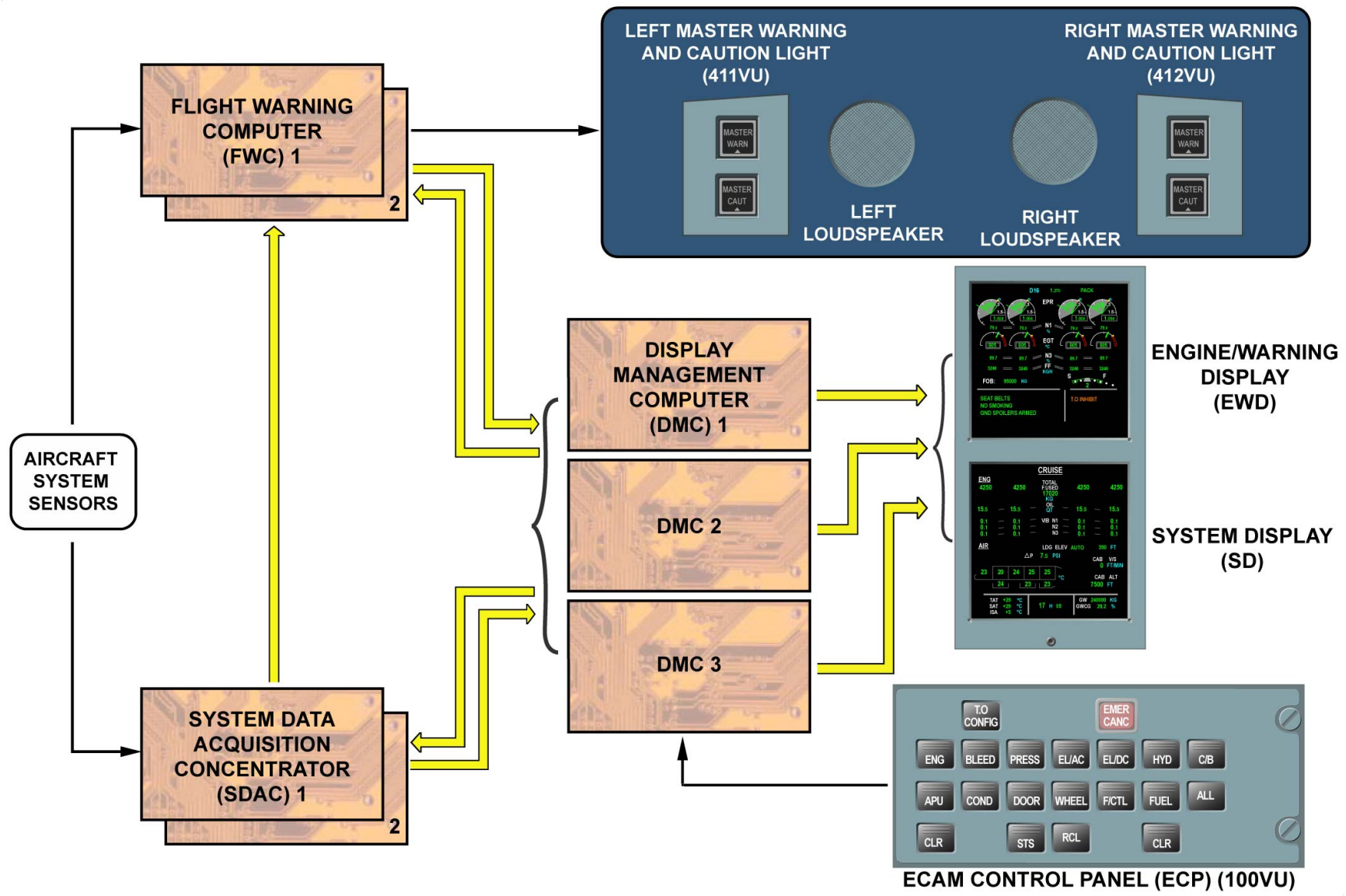
ECAM MODES - MANUAL MODE

# EIS ECAM ADVISORY & FAILURE MODE DESCRIPTION (3)

## GENERAL

The Flight Warning Computers (FWCs) directly activate the crew attention getters (aural and visual) and send the warning messages to the Display Management Computers (DMCs) for display. These attention getters, located on the glareshield, are the red MASTER WARNing indicator and the amber MASTER CAUTion indicator as well as aural sounds through the loudspeaker.

G9409341 - GAUT0T0 - FM31DD000000001




GENERAL

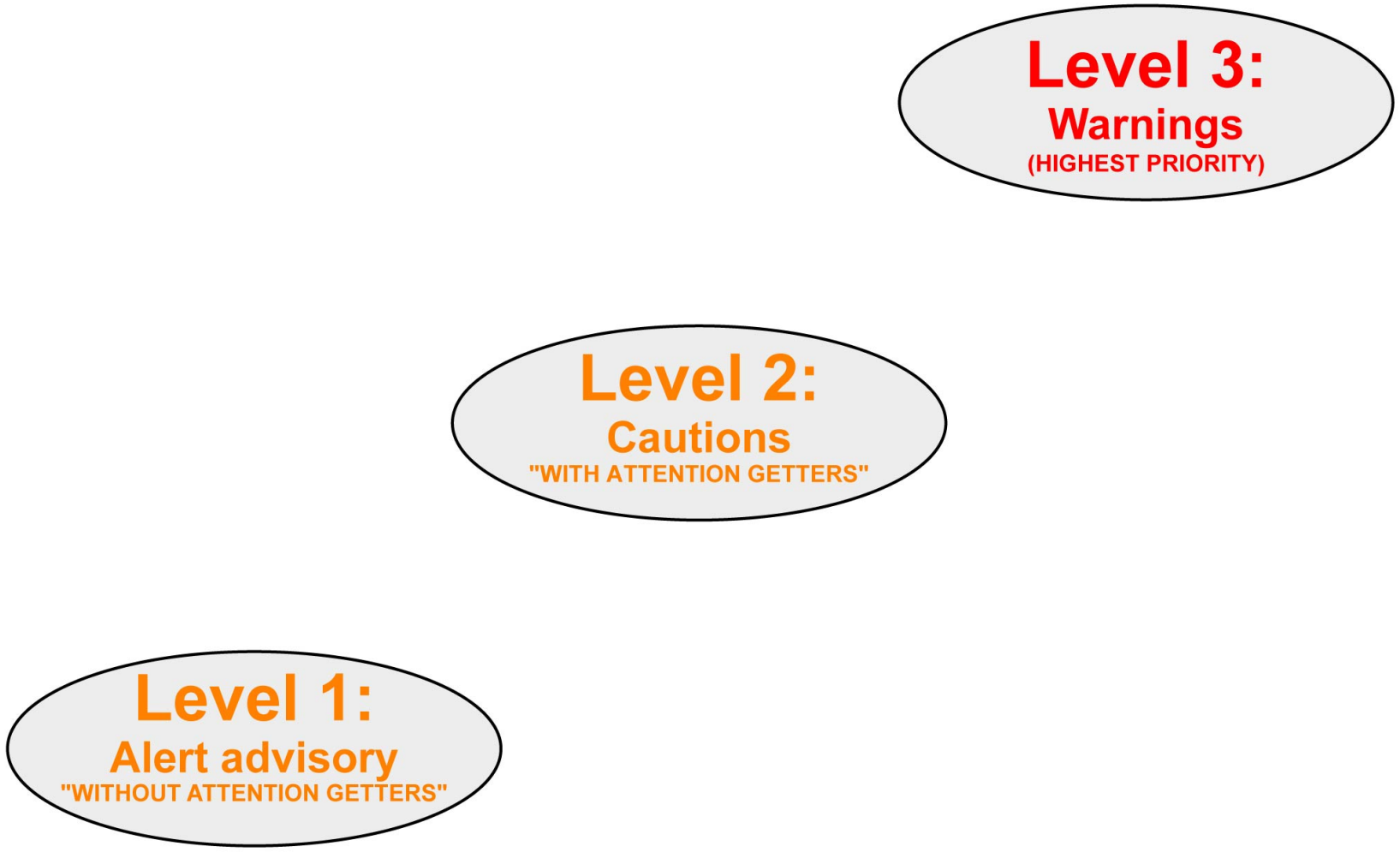
G9409341 - GAUT0T0 - FM31DD000000001

# EIS ECAM ADVISORY & FAILURE MODE DESCRIPTION (3)

## ECAM ALERT CLASSIFICATION

The alerts are classified in three levels. They depend on the importance and urgency of the corrective actions required.
LEVEL 1: alert advisory, without attention getters.
LEVEL 2: cautions, with attention getters (MASTER CAUT and sound).
LEVEL 3: red warnings, (highest priority), with attention getters (MASTER WARN + sound).
At each level, the alert messages are also classified by priority order. To explain the different levels of the alert classification, we will assume that you are in flight and everything is normal.

G9409341 - GAUT0T0 - FM31DD000000001




ECAM ALERT CLASSIFICATION

# EIS ECAM ADVISORY & FAILURE MODE DESCRIPTION (3)

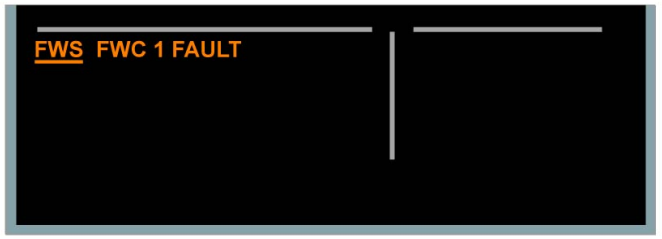
## ECAM ALERT CLASSIFICATION (continued)

### LEVEL 1: ALERT ADVISORY

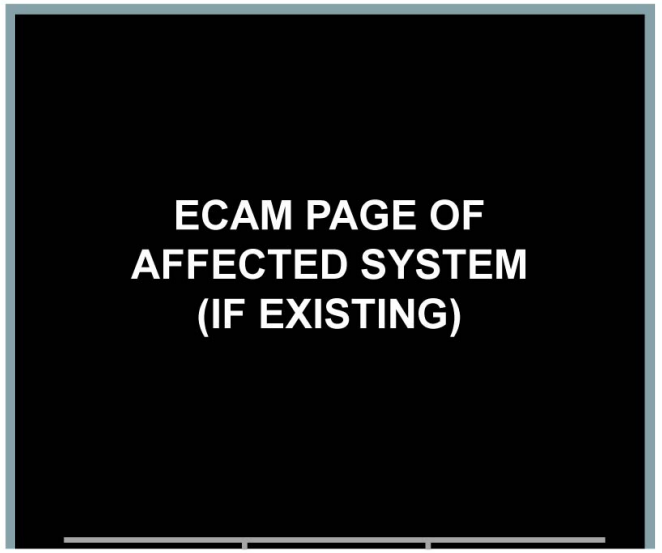
This corresponds to a configuration requiring crew monitoring, i.e. mainly failures leading to a loss of redundancy or degradation of a system. These alerts do not trigger any attention getters (visual and audio), but the related messages are displayed in amber on the EWD. The SD will display synoptic of affected system, if any.

G9409341 - GAUT0T0 - FM31DD000000001

**Level 1:**
**Alert advisory**
**"WITHOUT ATTENTION GETTERS"**




EWD




SD

ECAM ALERT CLASSIFICATION - LEVEL 1: ALERT ADVISORY

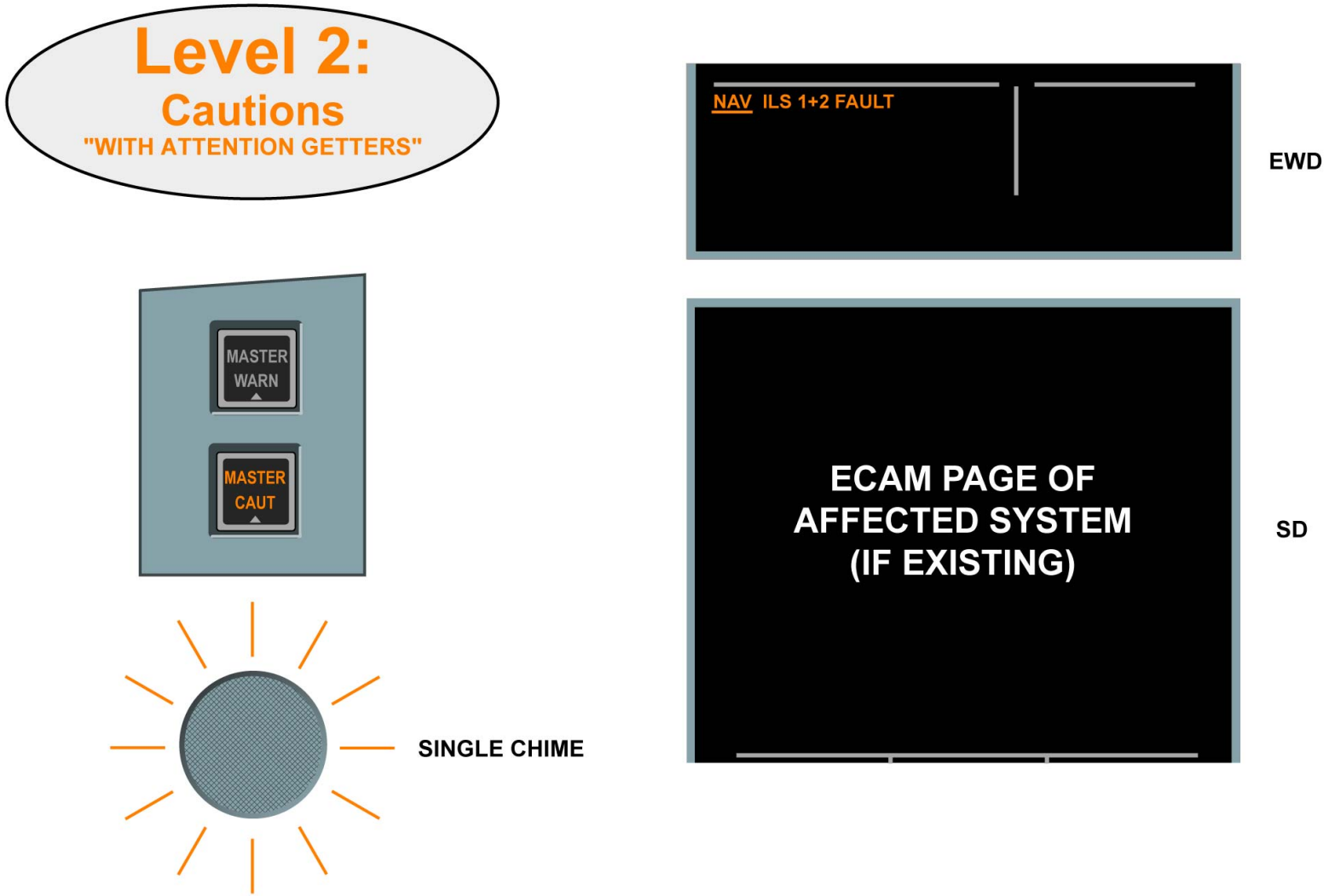
# EIS ECAM ADVISORY & FAILURE MODE DESCRIPTION (3)

## ECAM ALERT CLASSIFICATION (continued)

### LEVEL 2: CAUTIONS

This corresponds to an abnormal configuration of the aircraft, leading to an immediate crew awareness, but not necessarily an immediate crew corrective action. This level of alert is mainly for system failures, which have no immediate consequences on safety. These cautions are generally associated with a Single Chime (aural alert) and a MASTER CAUT amber light (steady visual alert).

G9409341 - GAUT0T0 - FM31DD000000001




ECAM ALERT CLASSIFICATION - LEVEL 2: CAUTIONS

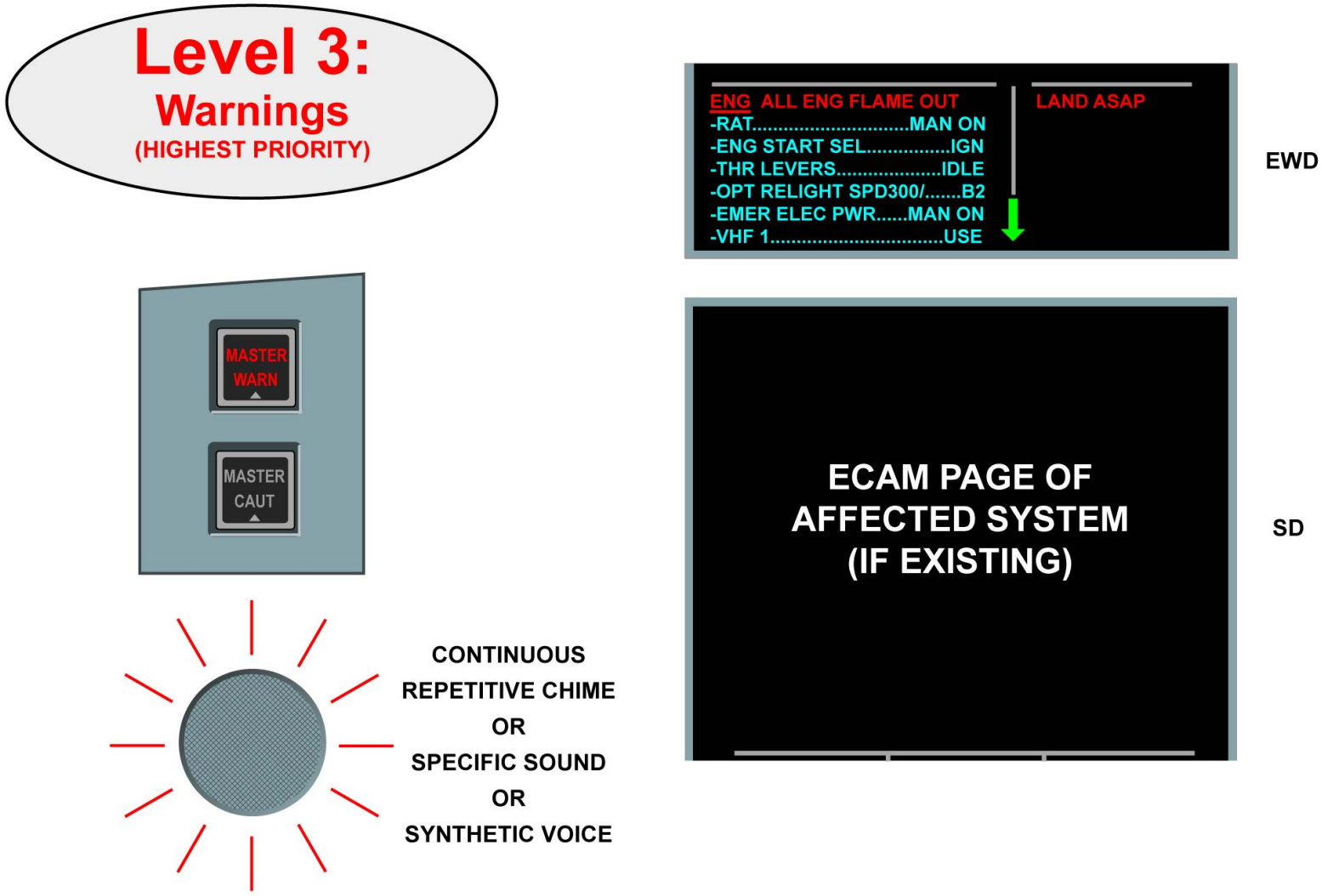
# EIS ECAM ADVISORY & FAILURE MODE DESCRIPTION (3)

## ECAM ALERT CLASSIFICATION (continued)

### LEVEL 3: WARNINGS (HIGHEST PRIORITY)

A level 3 message corresponds to an emergency configuration, a level 3 alert is triggered with the MASTER WARN flashing lights, a chime associated to the failure and a warning message. The crew must take corrective action.

G9409341 - GAUT0T0 - FM31DD000000001




ECAM ALERT CLASSIFICATION - LEVEL 3: WARNINGS (HIGHEST PRIORITY)

# EIS ECAM ADVISORY & FAILURE MODE DESCRIPTION (3)

## ECAM ALERT CLASSIFICATION (continued)

### STATUS MESSAGES

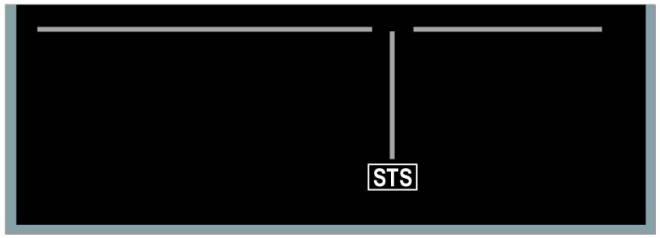
The status page indicates the A/C operational summary after a failure. This information is reported through a list of procedures, limitations and a list of inoperative systems. The status page appears during the normal sequence done by the flight crew to clear the message. It also appears automatically at slat/flap deployment on approach. The status page also presents the name of systems affected by a class 2 fault under the title MAINTENANCE. Those defects require further maintenance action and are also reported through the Central Maintenance System (CMS).

The STATUS page is displayed when the crew presses, on the ECAM Control Panel (ECP):

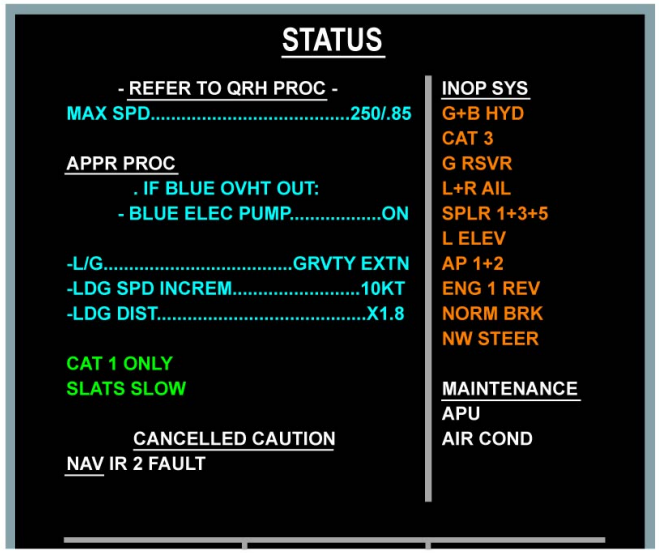
- the CLR key for the last time after a failure presentation,
- or the STS key.

A white boxed STS reminder on the EWD reminds the crew that the status page is not empty. After engine shutdown, this STS reminder may flash if a class 2 fault (MAINTENANCE) is reported.

G9409341 - GAUT0T0 - FM31DD000000001




EWD




SD

ECAM CONTROL PANEL (ECP) (100VU)

ECAM ALERT CLASSIFICATION - STATUS MESSAGES

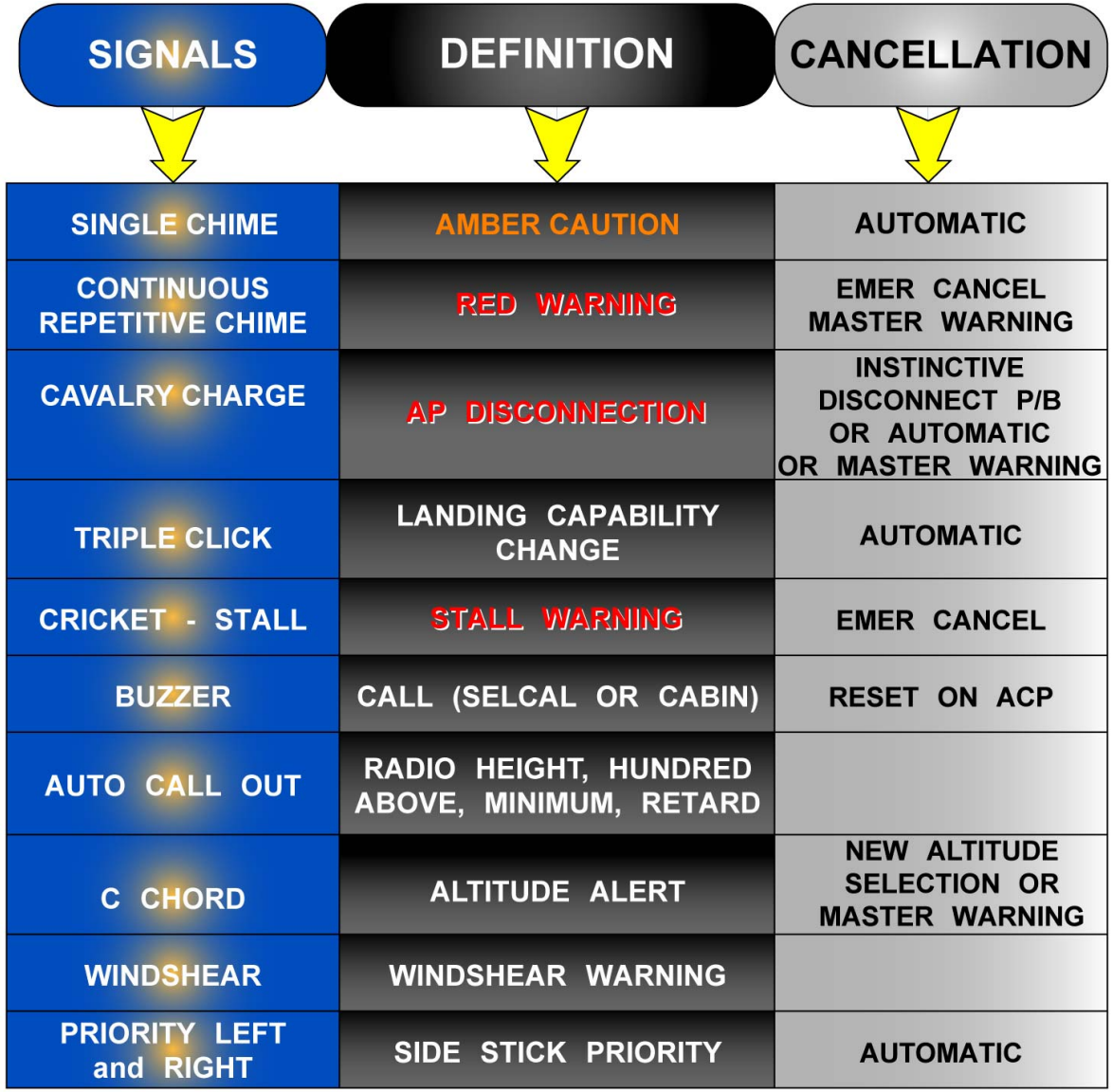
G9409341 - GAUT0T0 - FM31DD000000001

# EIS ECAM ADVISORY & FAILURE MODE DESCRIPTION (3)

## AUDIO SIGNALS

This topic presents the different audio signals generated by the FWC and the manner of cancellation.

G9409341 - GAUT0T0 - FM31DD000000001



| SIGNALS | DEFINITION | CANCELLATION |
|---|---|---|
| SINGLE CHIME | AMBER CAUTION | AUTOMATIC |
| CONTINUOUS REPETITIVE CHIME | RED WARNING | EMER CANCEL MASTER WARNING |
| CAVALRY CHARGE | AP DISCONNECTION | INSTINCTIVE DISCONNECT P/B OR AUTOMATIC OR MASTER WARNING |
| TRIPLE CLICK | LANDING CAPABILITY CHANGE | AUTOMATIC |
| CRICKET - STALL | STALL WARNING | EMER CANCEL |
| BUZZER | CALL (SELCAL OR CABIN) | RESET ON ACP |
| AUTO CALL OUT | RADIO HEIGHT, HUNDRED ABOVE, MINIMUM, RETARD | |
| C CHORD | ALTITUDE ALERT | NEW ALTITUDE SELECTION OR MASTER WARNING |
| WINDSHEAR | WINDSHEAR WARNING | |
| PRIORITY LEFT and RIGHT | SIDE STICK PRIORITY | AUTOMATIC |

AUDIO SIGNALS

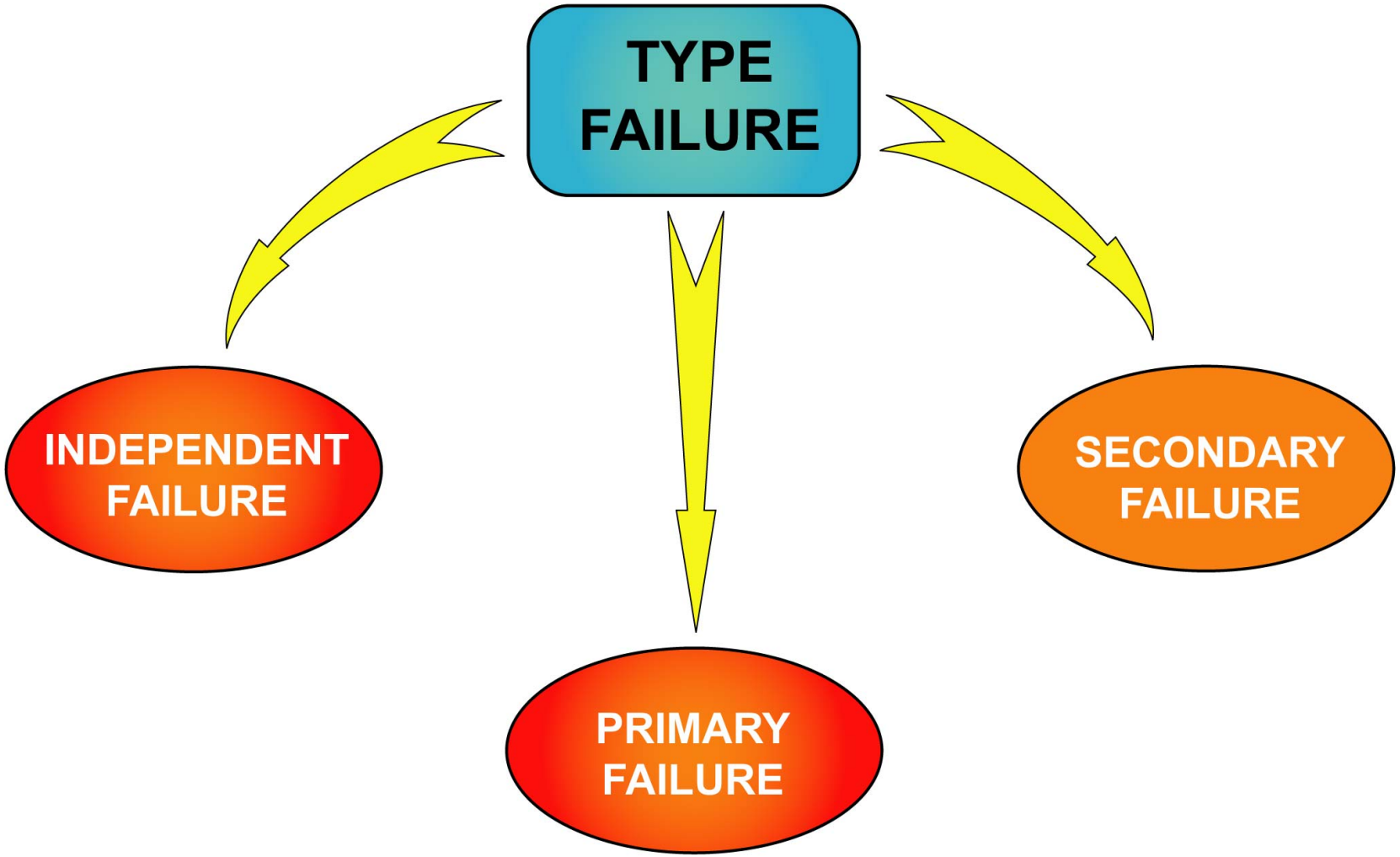
G9409341 - GAUT0T0 - FM31DD000000001

# EIS ECAM ADVISORY & FAILURE MODE DESCRIPTION (3)

## ECAM TYPE OF FAILURE

The failures displayed may be of three different types, without depending on their classification:
- an independent failure,
- a primary failure,
- a secondary failure.

G9409341 - GAUT0T0 - FM31DD000000001




ECAM TYPE OF FAILURE

G9409341 - GAUT0T0 - FM31DD000000001

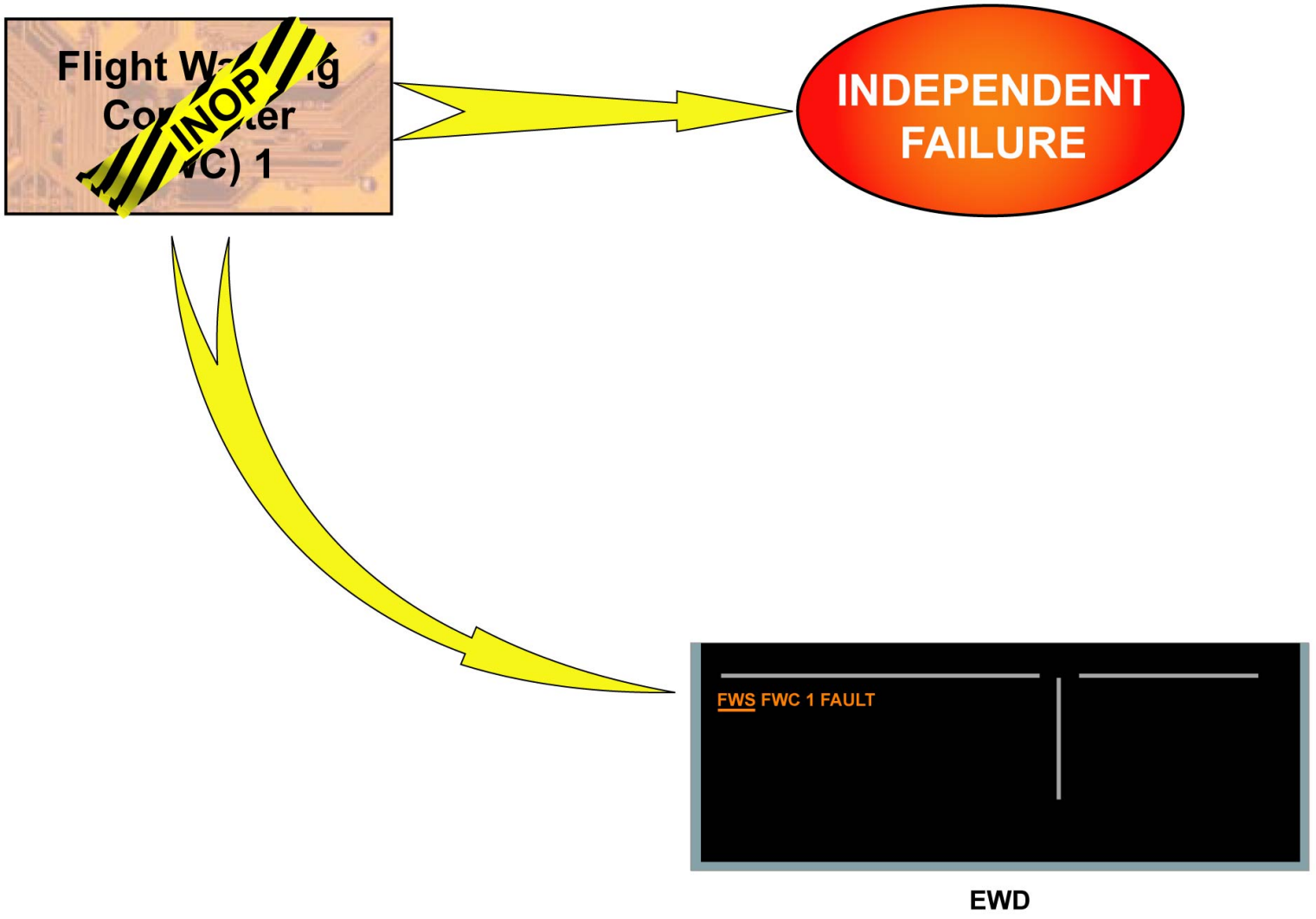
# EIS ECAM ADVISORY & FAILURE MODE DESCRIPTION (3)

## ECAM TYPE OF FAILURE (continued)

### INDEPENDENT FAILURE

When a warning appears as an independent failure, it is a failure, which affects an isolated system or a piece of equipment without affecting another one. For example: a FWC 1 failure.

G9409341 - GAUT0T0 - FM31DD000000001




ECAM TYPE OF FAILURE - INDEPENDENT FAILURE

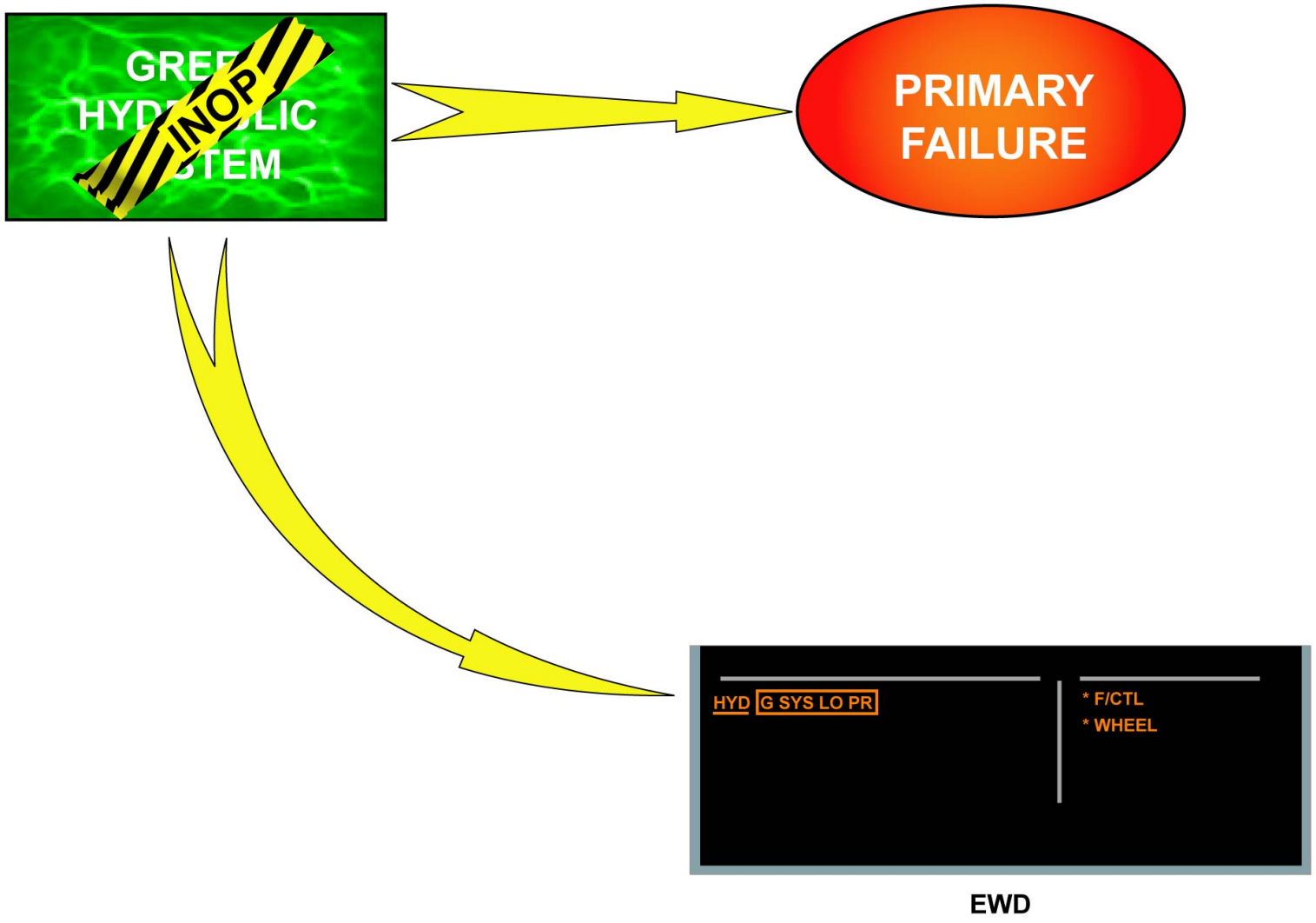
# EIS ECAM ADVISORY & FAILURE MODE DESCRIPTION (3)

## ECAM TYPE OF FAILURE (continued)

### PRIMARY FAILURE

A primary failure is a failure of a system or a function which affect other systems or equipment. For example, the green hydraulic system failure leads to the loss of a pair of spoilers. Note that a primary failure is displayed with a box around the failure in red or amber.

G9409341 - GAUT0T0 - FM31DD000000001




ECAM TYPE OF FAILURE - PRIMARY FAILURE

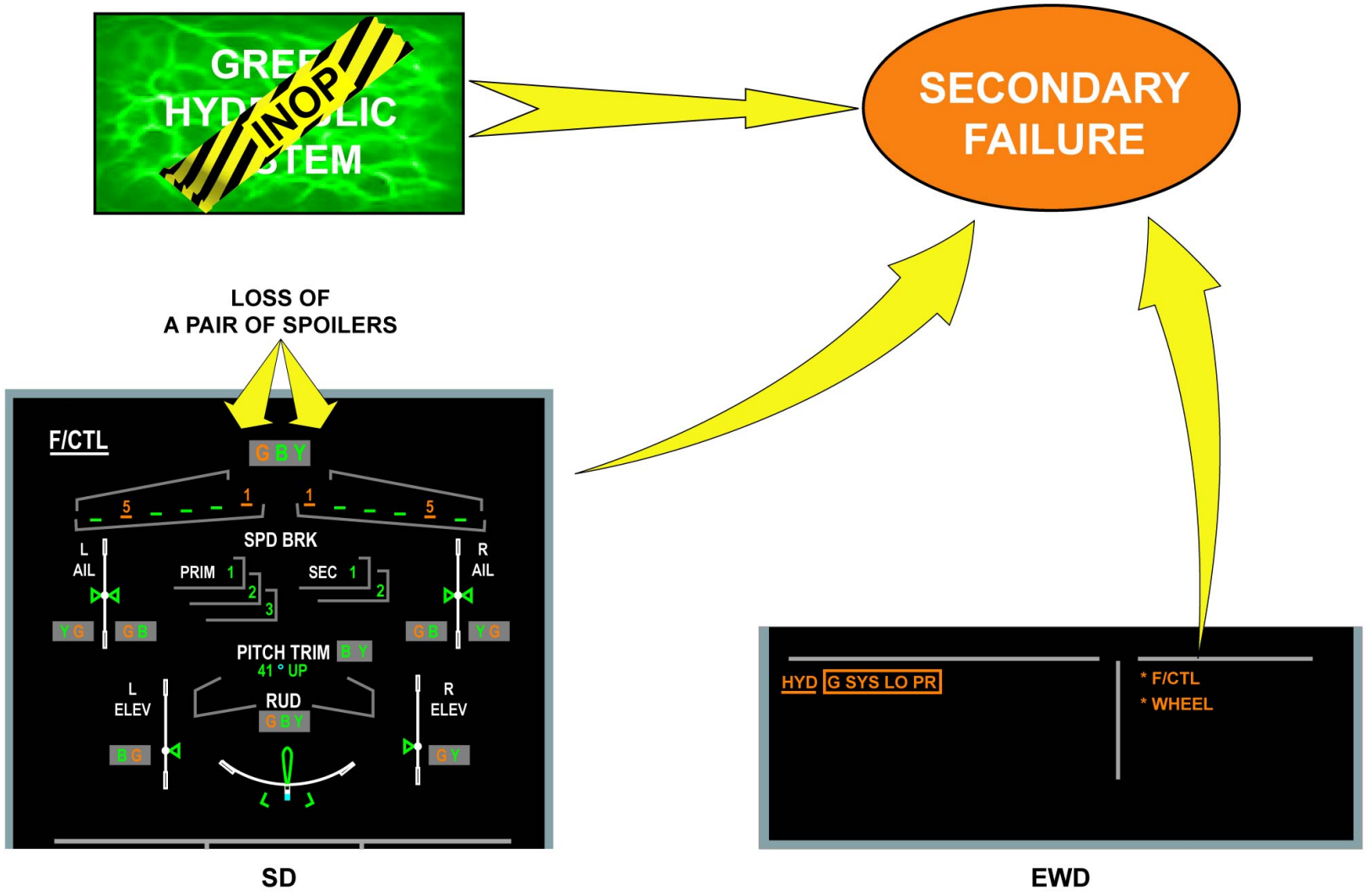
# EIS ECAM ADVISORY & FAILURE MODE DESCRIPTION (3)

## ECAM TYPE OF FAILURE (continued)

### SECONDARY FAILURE

A secondary failure is the loss of a system or an item of equipment resulting from a primary failure: for example, the loss of a pair of spoilers following the loss of the green hydraulic system (hydraulic system deactivation). The titles of the system pages related to the secondary failures are indicated on the lower right part of the EWD. They are displayed in amber with an asterisk. Note that this right part can also be used if necessary to display heading titles of warnings if the left part of the EWD is full.

G9409341 - GAUT0T0 - FM31DD000000001




ECAM TYPE OF FAILURE - SECONDARY FAILURE

G9409341 - GAUT0T0 - FM31DD000000001

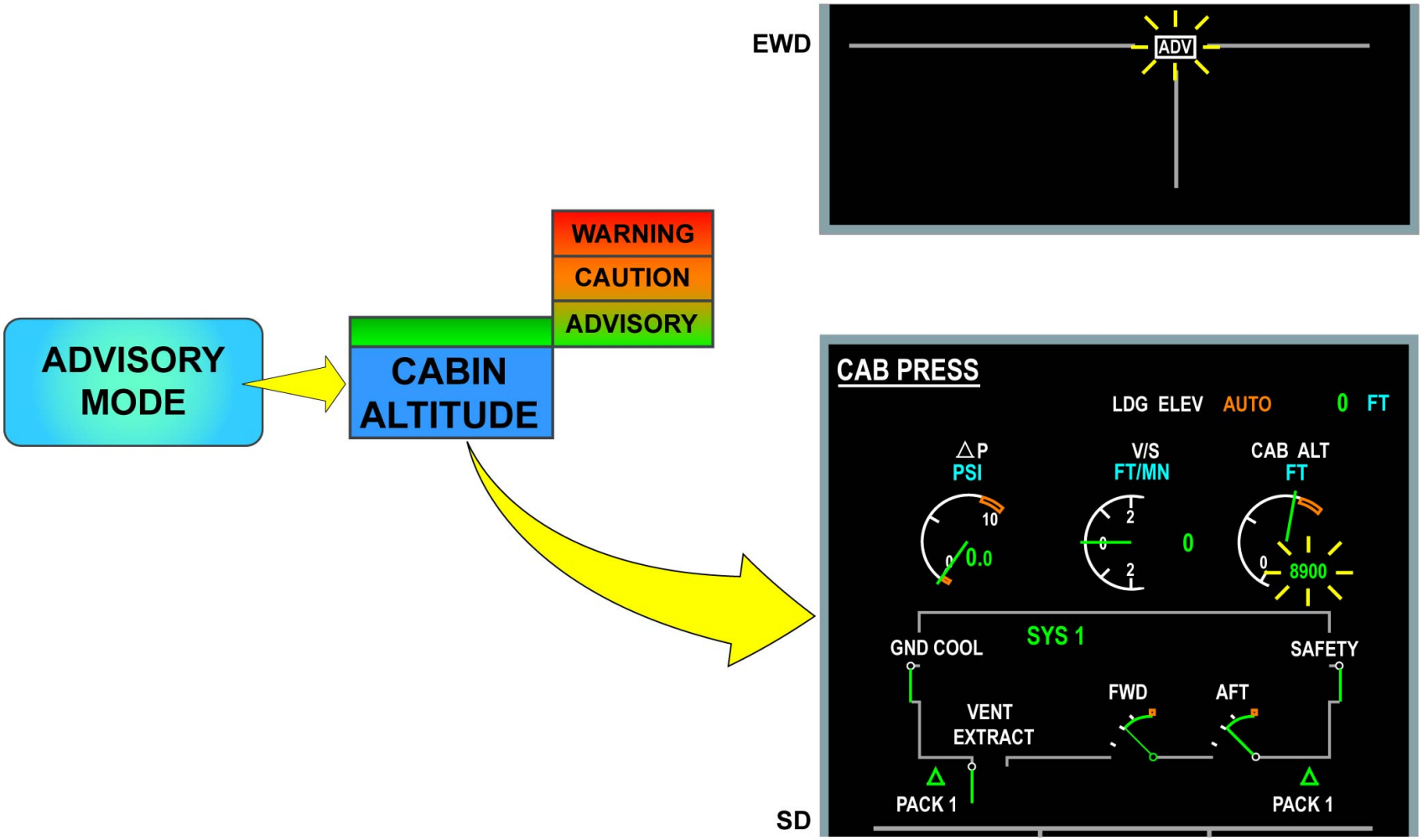
# EIS ECAM ADVISORY & FAILURE MODE DESCRIPTION (3)

## ECAM ADVISORY AND FAILURE MODE

### DUAL DISPLAY MODE

The advisory mode lets the value of some critical system parameters be monitored, and by getting the flight crew attention onto the drifting parameter.
When the value drifts from its normal range, the related ECAM page is displayed automatically, the affected parameter pulses and a white ADV message pulses at the bottom of the EWD.
For example, the cabin altitude increases above its normal value, but is still well below the threshold of the warning. The CAB PRESS page appears automatically with a pulsing value for the cabin altitude. In this case the crew may revert to manual pressure control and prevent warning activation.

G9409341 - GAUT0T0 - FM31DD000000001




ECAM ADVISORY AND FAILURE MODE - DUAL DISPLAY MODE

G9409341 - GAUT0T0 - FM31DD000000001

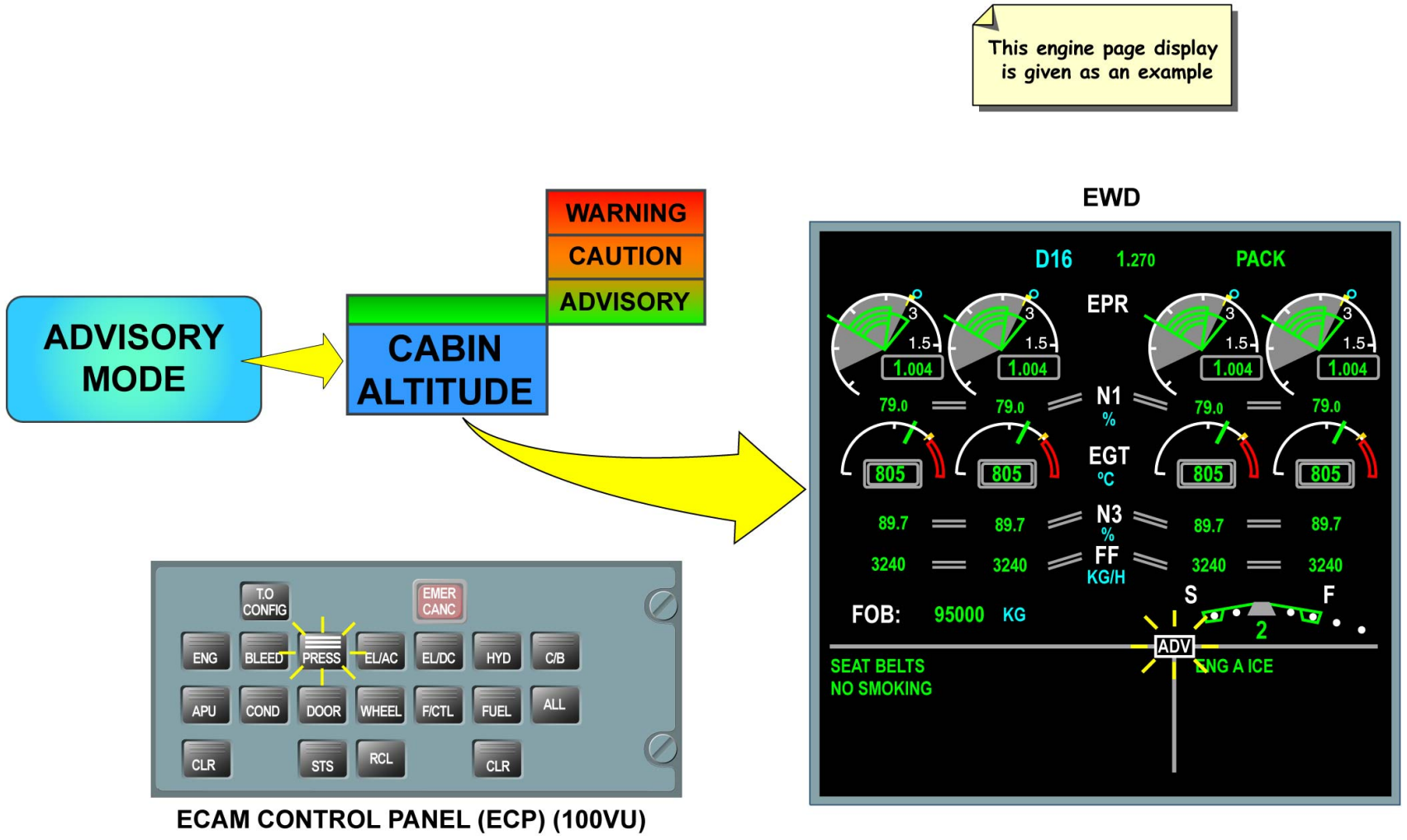
# EIS ECAM ADVISORY & FAILURE MODE DESCRIPTION (3)

## ECAM ADVISORY AND FAILURE MODE (continued)

### SINGLE DISPLAY MODE

In single display mode (one ECAM Liquid Crystal Display (LCD) unit remaining), a white ADV message pulses at the bottom of the EWD to attract crew attention. The related system page cannot be displayed automatically on the SD. The pilot has to push and hold the related system flashing key on the ECP to check the system on the ECAM page.

G9409341 - GAUT0T0 - FM31DD000000001




ECAM ADVISORY AND FAILURE MODE - SINGLE DISPLAY MODE

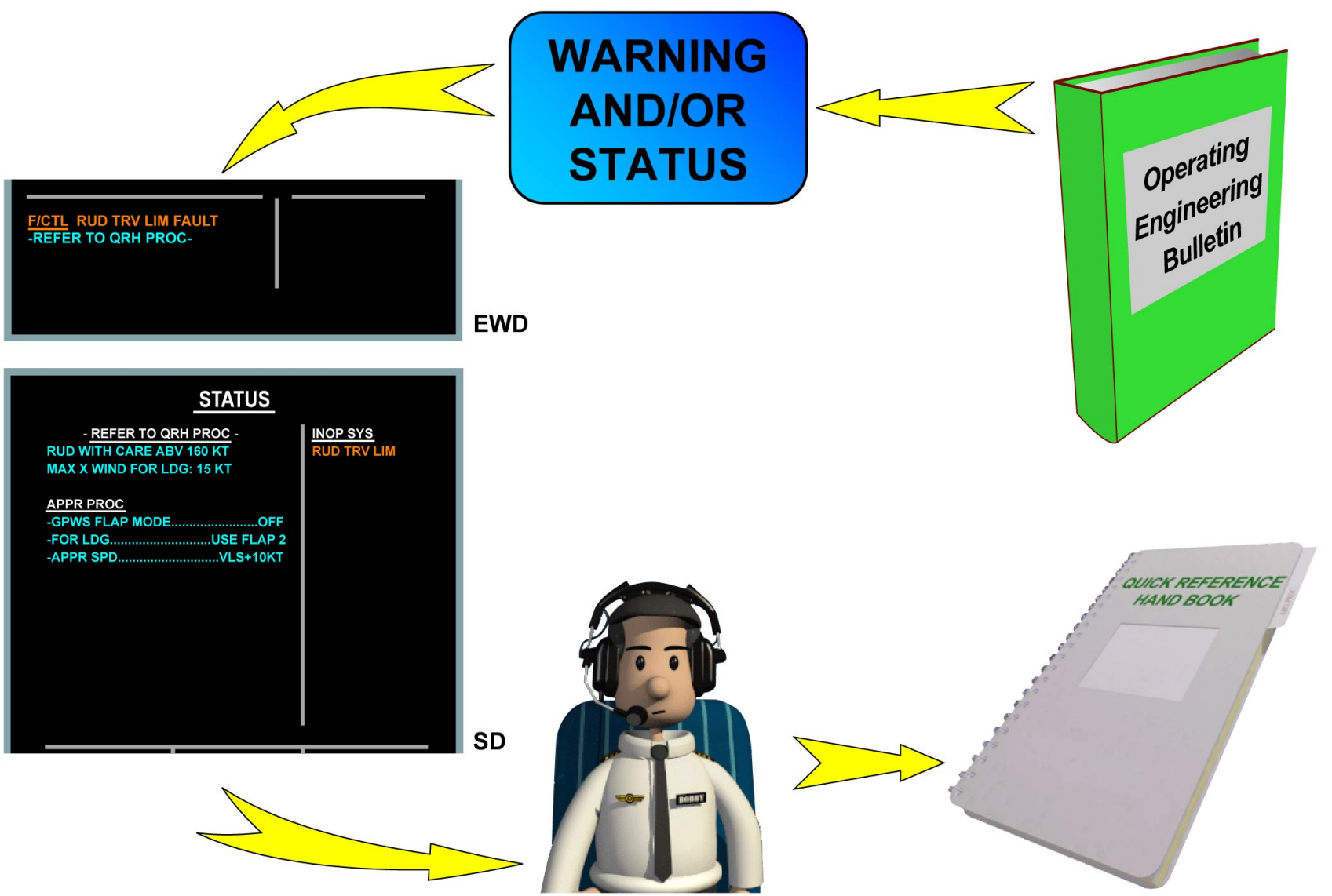
G9409341 - GAUT0T0 - FM31DD000000001

# EIS ECAM ADVISORY & FAILURE MODE DESCRIPTION (3)

## ECAM OPERATIONS ENGINEERING BULLETIN

When a warning and/or a status is affected by an Operating Engineering Bulletin, a message is displayed to remind the crew that an Operating Engineering Bulletin exists and that they must refer to the Quick Reference Handbook to get access to the correct procedure.

G9409341 - GAUT0T0 - FM31DD000000001




ECAM OPERATIONS ENGINEERING BULLETIN

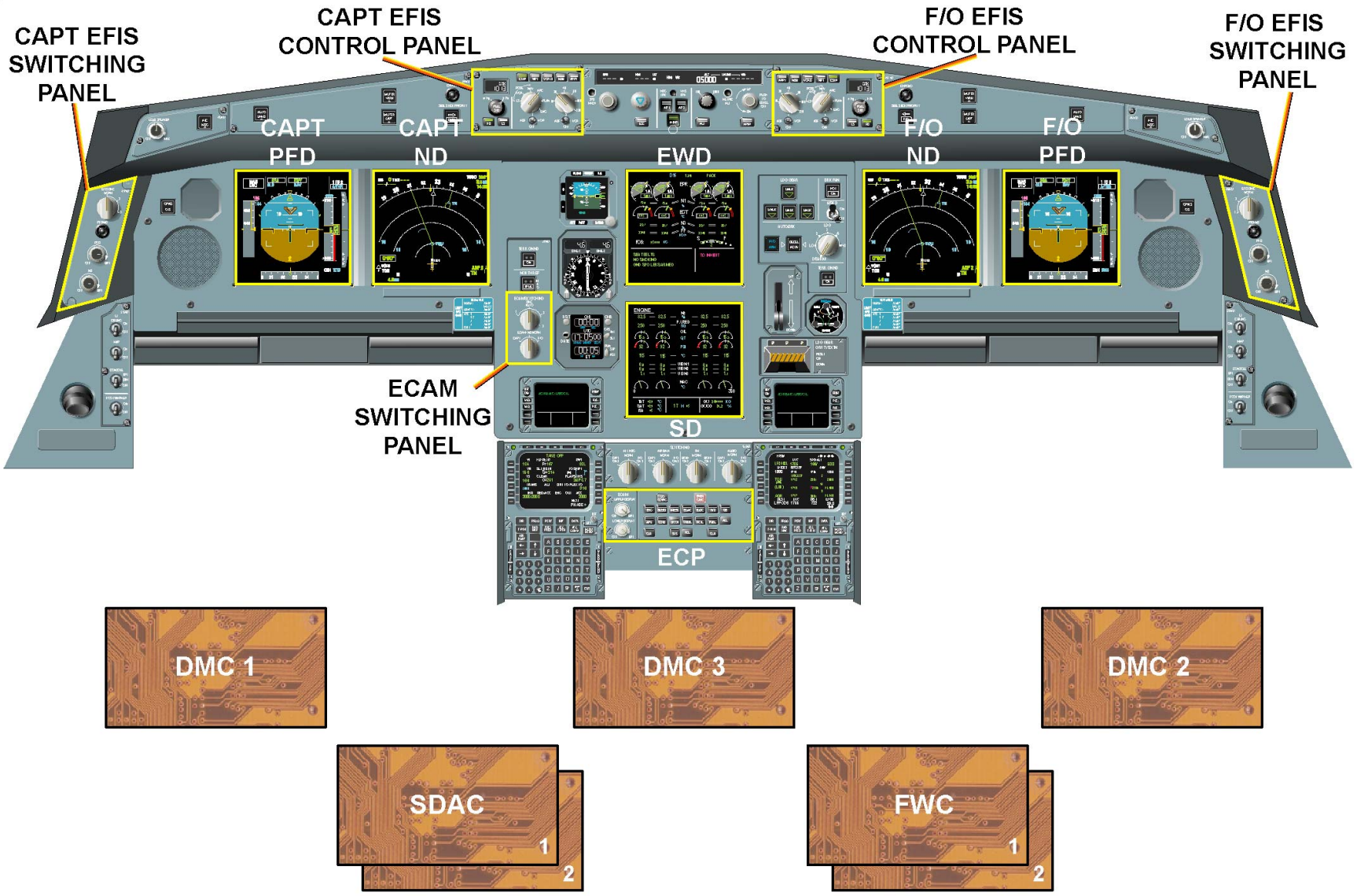
# EIS D/O (3)

## GENERAL

The EIS interface architecture is designed to cope with REDUNDANCY/SEGREGATION/RECONFIGURATION requirements which give advantages such as:
- no operational degradation in case of failure of an EIS Line Replaceable Unit (LRU),
- reliable presentation on Display Units (DUs) of aircraft system configuration,
- easy failure recovery procedures.

The EIS architecture is designed around 6 identical Liquid Crystal Display (LCD) units and 3 Data Management Computers (DMCs). For the ECAM part, the systems data are processed through 2 System Data Acquisition Concentrators (SDACs) and 2 Flight Warning Computers (FWCs).

G9409341 - GAUT0T0 - FM31D2000000002


CAPT EFIS SWITCHING PANEL
CAPT EFIS CONTROL PANEL
F/O EFIS CONTROL PANEL
F/O EFIS SWITCHING PANEL
CAPT PFD
CAPT ND
EWD
F/O ND
F/O PFD
ECAM SWITCHING PANEL
SD
ECP
DMC 1
DMC 3
DMC 2
SDAC
1
2
FWC
1
2

GENERAL

# EIS D/O (3)

## GENERAL (continued)

### SDAC

The two SDACs are identical and interchangeable.
They fulfill three main functions:
- data acquisition,
- data concentration,
- data digitization.

The two SDACs acquire, concentrate, digitize and send, to the three DMCs, all the aircraft system signals necessary to be displayed on the ECAM SD. The SDACs acquire, from the aircraft systems, the malfunction and the failure data corresponding to caution situations and send them to the FWCs. The FWCs then process and generate corresponding alert and procedure messages. All the signals (discrete, analog, digital) entering the SDAC are concentrated and converted into digital format (ARINC 429). The SDAC operational software is contained in a specific device called the On Board Replaceable Module (OBRM).

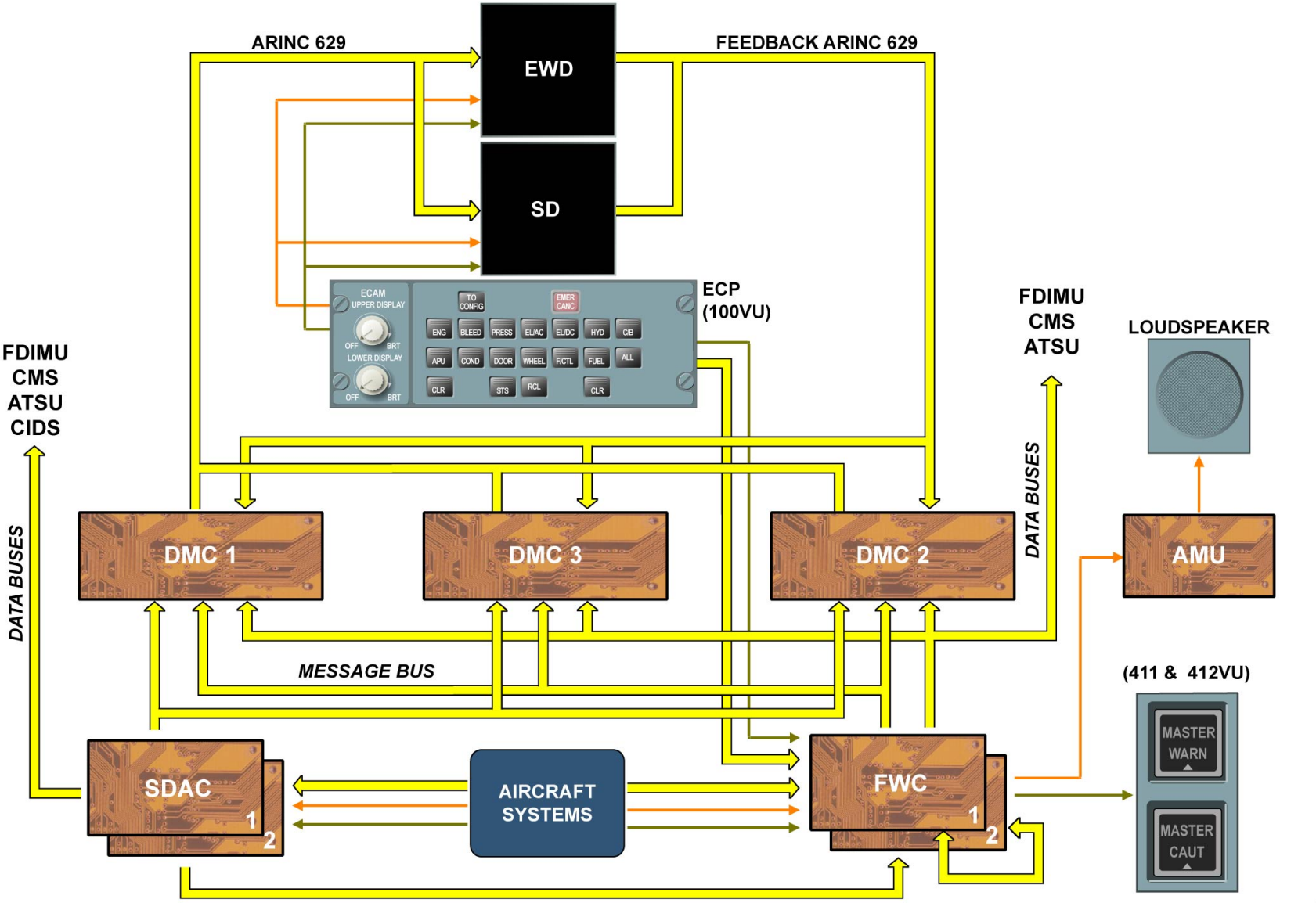
### FWC

The two FWCs are identical and interchangeable.
They fulfill three main functions:
- data acquisition,
- data warning computation corresponding to warning situations,
- flight phase computation.

The FWCs also generate aural alerts as well as synthetic voices for radio height, automatic call out and other audible announcements. They are sent to the Audio Management Unit (AMU) for broadcasting by the cockpit loudspeakers. Each FWC generates all texts and messages to be displayed on the ECAM DUs. These messages are system and warning titles, procedures associated with the warnings, status and memos. The FWCs acquire failure data for the red warnings. Those data are acquired directly from the aircraft systems and do not involve the SDACs. The FWCs are also tasked with the acquisition of SDAC DATA BUSES, generating the text for a caution message and providing the associated attention getter.
Each FWC sends a copy of its own acquisition through the ARINC 429 bus to the opposite FWC for redundancy.
The FWC outputs are:
- discrete for visual attention getters,
- discrete and analog for audio signals,
- ARINC 429 FWC DATA BUS (Central Maintenance Computer (CMC)/Flight Data Interface and Management Unit (FDIMU)),
- ARINC 429 FWC MESSAGE BUS.

The FWC operational software is contained into 2 OBRMs. Each FWC includes a BITE to detect the failures for maintenance operations.

G9409341 - GAUT0T0 - FM31D2000000002




GENERAL - SDAC & FWC

# EIS D/O (3)

## GENERAL (continued)

### DMC

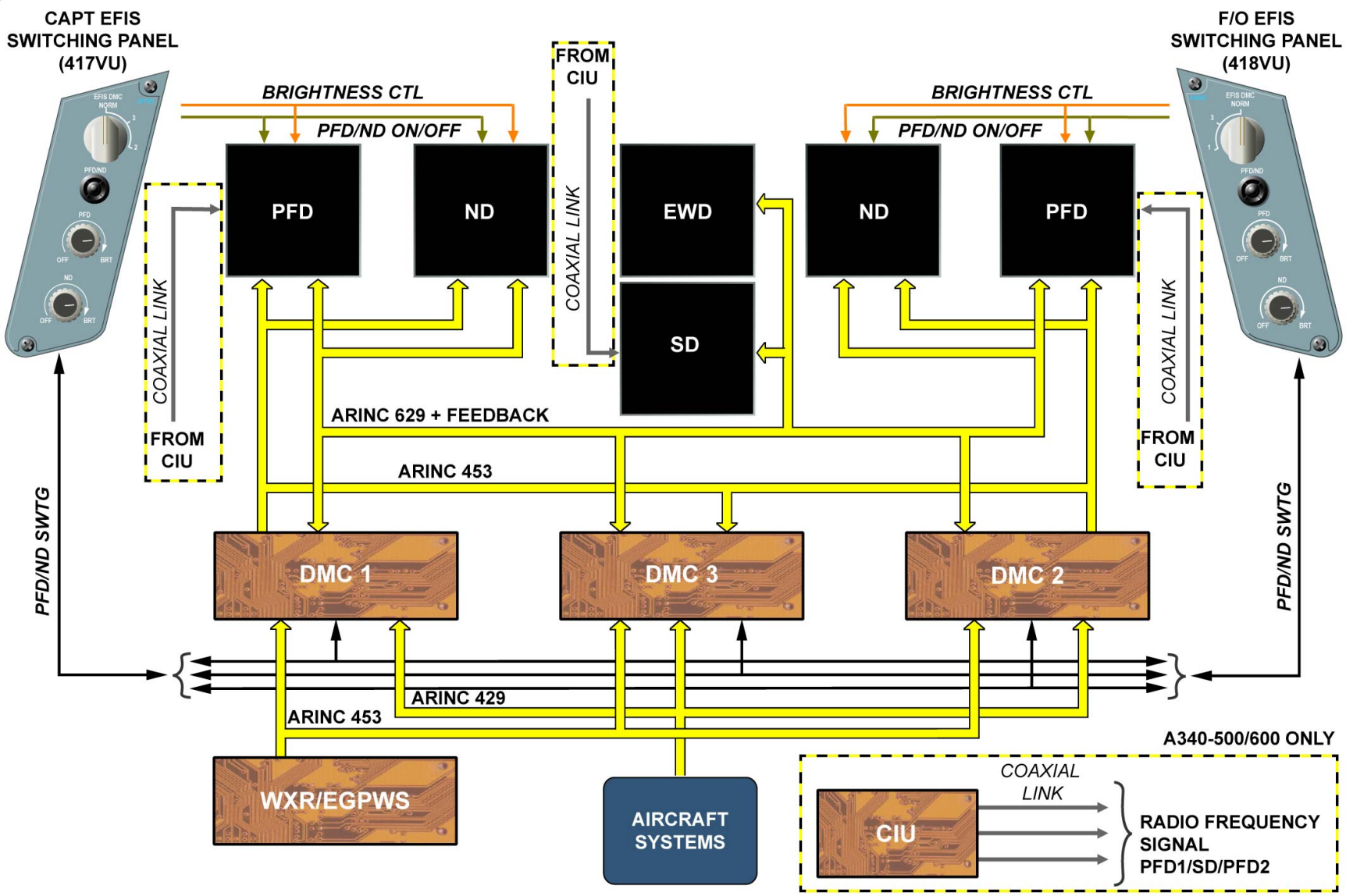
The 3 DMCs are identical and interchangeable. They acquire and process signals received from the aircraft systems or through the SDACs and FWCs for the computation of the different EFIS and ECAM displays.
Each DMC receives the same type of data from the aircraft systems, SDACs and FWCs through ARINC 429 buses. It receives ARINC 453 for RADAR/Enhanced Ground Proximity Warning System (EGPWS) data, RS 232 (shop test) and discrete signals for DU reconfiguration.
The DMC then transmits the data to all DUs through an ARINC 629 bus. Each DU acquires data that is useful for its function either EFIS or ECAM.
For DU feedback, each DU transmits to the three DMCs through an ARINC 629 return bus:
- an acknowledge signal,
- critical parameter feedback,
- a DU failure information.

The DMCs also provide ARINC 429 output buses for the FWCs, CMC, FDIMU, ECAM Control Panel (ECP) and EFIS control panel.
Each DMC has a BITE for itself and for its connected DUs for maintenance operations.

### DISPLAY UNITS

The EIS system has 6 back-lighted LCD units, which are identical and interchangeable. The LCD units are SMART displays, this means that each display contains its own processing capability in order to compute and to generate the required image to display on the PFD, ND, EWD or SD. Each LCD units receives and processes data through an ARINC 629 High Speed (HS) bus from the 3 DMCs and through an ARINC 453 for weather radar (WXR) and EGPWS (BITMAP images) data from DMC1 and 2. In addition, the PFD CAPT, PFD F/O, and SD units are connected to the Camera Interface Unit (CIU) and display function for the Taxiing Aid Camera System (TACS).
The TACS is installed on A340-600, and optionally on A340-500.
The RS 232 interface is used for TACS software test.
The interface with the EFIS switching panel for failure recovery and redundancy is done by discrete and analog signals. In turn the LCD units send back to the DMC and to the monitoring DUs critical parameter feedback via ARINC 629 bus.

G9409341 - GAUT0T0 - FM31D2000000002




GENERAL - DMC & DISPLAY UNITS

# EIS D/O (3)

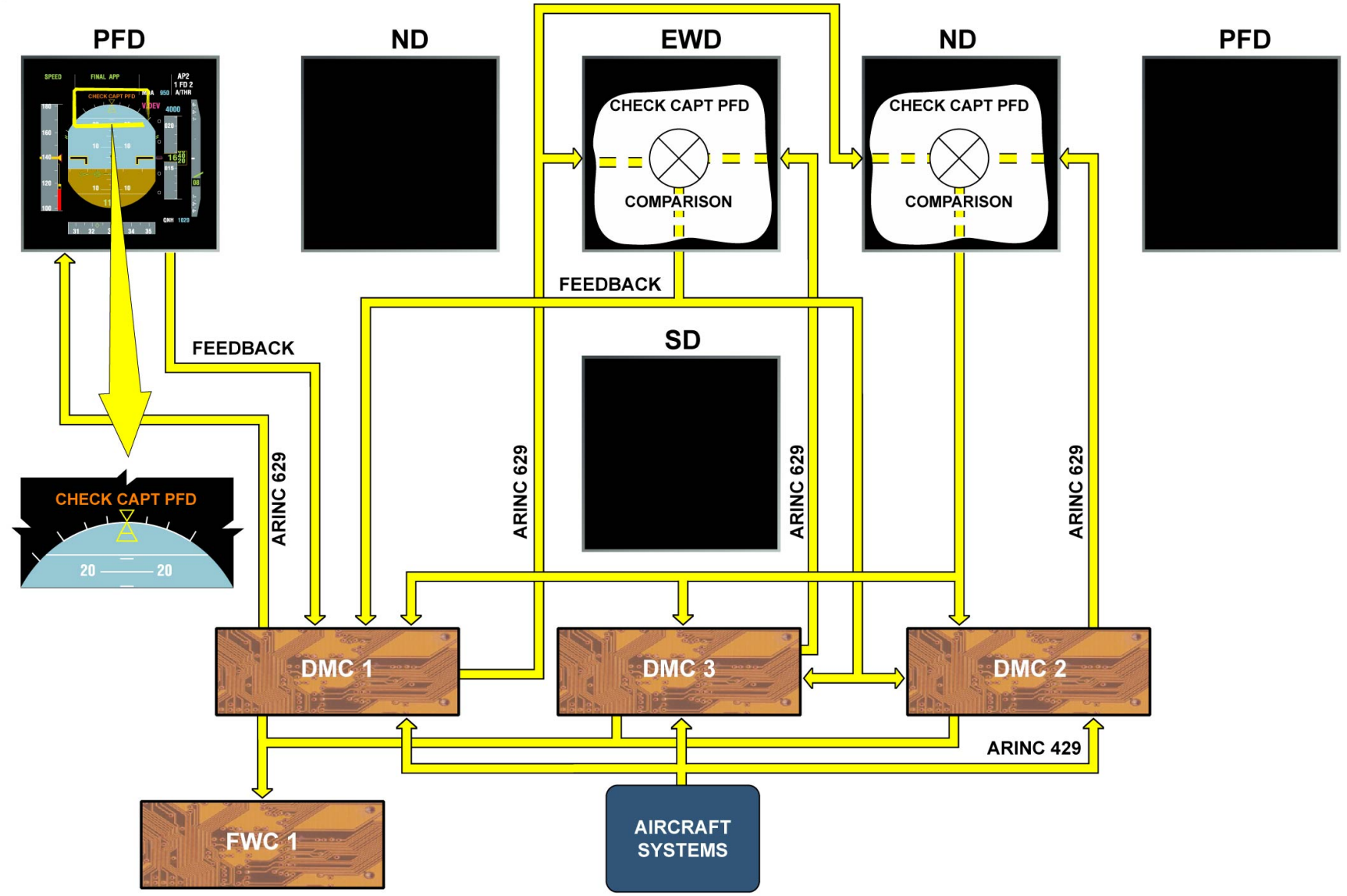
## GENERAL (continued)

### FEEDBACK MONITORING FUNCTION

The feedback monitoring function is made by the DU. Each DU monitors 2 images as follows:
- CAPT PFD image is monitored by EWD and F/O ND,
- CAPT ND image is monitored by EWD and F/O PFD,
- F/O PFD image is monitored by SD and CAPT ND
- F/O ND image is monitored by SD and CAPT PFD,
- EWD image is monitored by CAPT and F/O PFDs,
- SD image is monitored by CAPT and F/O NDs.

On the graphic, the feedback monitoring function is illustrated for CAPT PFD image only. For these critical parameters, e.g. attitude, altitude, heading, the data processed in the monitored DU are sent to the 2 monitoring DUs through the DMCs. The feedback value is sent to the other DUs for comparison with the originating sensor values and when a discrepancy is detected the monitoring DU displays an amber message (ie.CHECK CAPT PFD) and triggers a warning to generate on the FWC. When this message is triggered, it is stored in the DU BITE zone but not transmitted to DMCs.

G9409341 - GAUT0T0 - FM31D2000000002




GENERAL - FEEDBACK MONITORING FUNCTION

G9409341 - GAUT0T0 - FM31D2000000002

# EIS D/O (3)

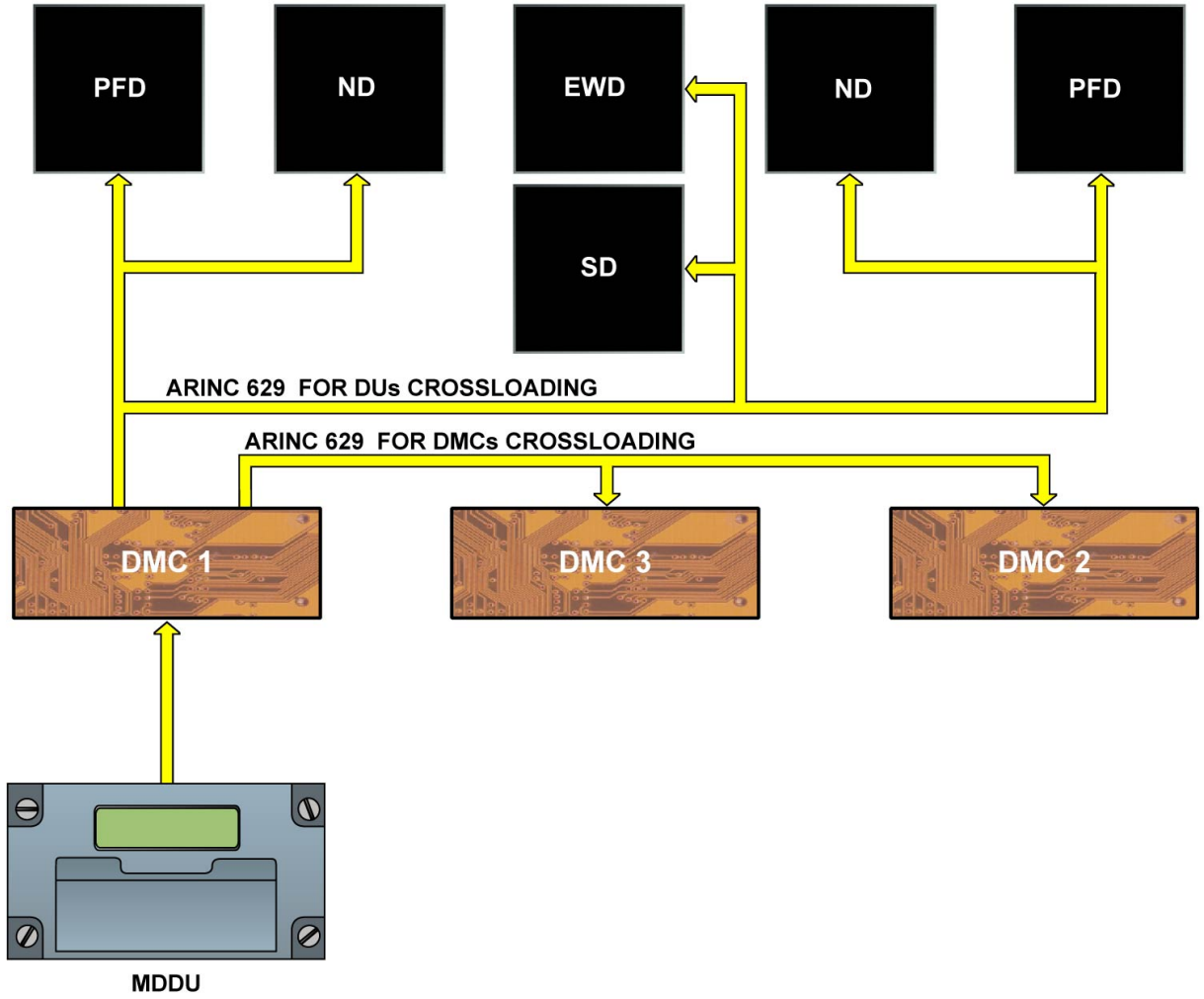
## GENERAL (continued)

### DMC/DU SOFTWARE TELE-LOADING

The tele-loading function is used in order to update the software in the DMCs and in the DUs. This function is divided into 3 sub-functions:
- tele-loading from the Multipurpose Disk Drive Unit (MDDU) or a portable data loader into a DMC (uploading procedure),
- tele-loading from a DMC to the 6 DUs at the same time through the MCDU (DU cross-loading procedure) and,
- tele-loading from a DMC to another DMC through the MCDU (DMC cross-loading procedure).

LCD unit software updating can be done by either DMC. Normally, DMC 1 is used to update CAPT EFIS, DMC 2 for F/O EFIS and DMC 3 for ECAM. Alternatively, any DMC can also be used following appropriate switching. DMC software updating can be performed by either uploading software from MDDU to DMC 1 and then cross-loaded to DMC 2 or DMC 3, or cross-loading software to/from an opposite DMC. The cross-loading function is made through ARINC 629 buses. The DMCs and DUs software comprise the combination of the pin programs. In this example, the 3 different tele-loading sub-functions are shown.

G9409341 - GAUT0T0 - FM31D2000000002




GENERAL - DMC/DU SOFTWARE TELE-LOADING

# EIS D/O (3)

## CONTROL PANELS

The following control panels control and operate the EIS.

### EFIS CONTROL PANEL

The EFIS control panels, which are part of the Flight Control Unit (FCU), are linked to the DMCs by ARINC 429 buses. The CAPT EFIS control panel supplies DMC1 and DMC3, whereas the F/O EFIS control panel supplies DMC2 and DMC3.

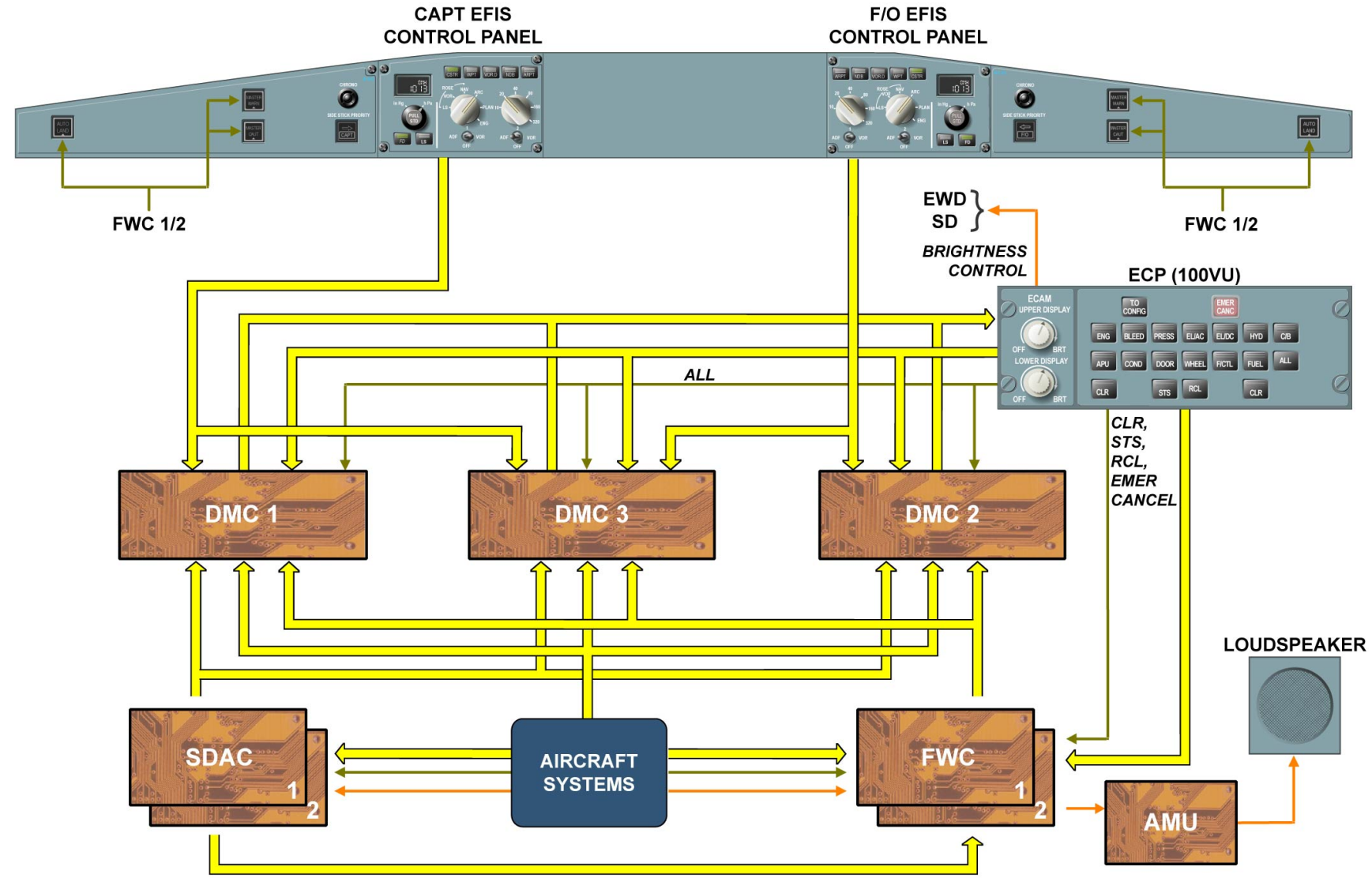
### ECAM CONTROL PANEL

The ECP transmits the pilot selections to the FWCs and DMCs via a low speed ARINC 429 bus. It receives the DMC data in order to diplay the relevant system page. Some of the ECP outputs are discrete for redundancy purposes. They are the CLeaR, ReCaLl, STatuS and EMERgency CANCEL keys and are hardwired to the FWCs. The ALL key is hardwired to the DMCs. The ECP is also linked to the DUs brightness control.

### WARNING AND CAUTION SIGNALS

Both Master Warning and Master Caution lights are controlled by each FWC.
The AMU receives audio signals from the FWC and sends the audios signals to the cockpit loudspeakers.

G9409341 - GAUT0T0 - FM31D2000000002




CONTROL PANELS - EFIS CONTROL PANEL ... WARNING AND CAUTION SIGNALS

G9409341 - GAUT0T0 - FM31D2000000002

# EIS D/O (3)

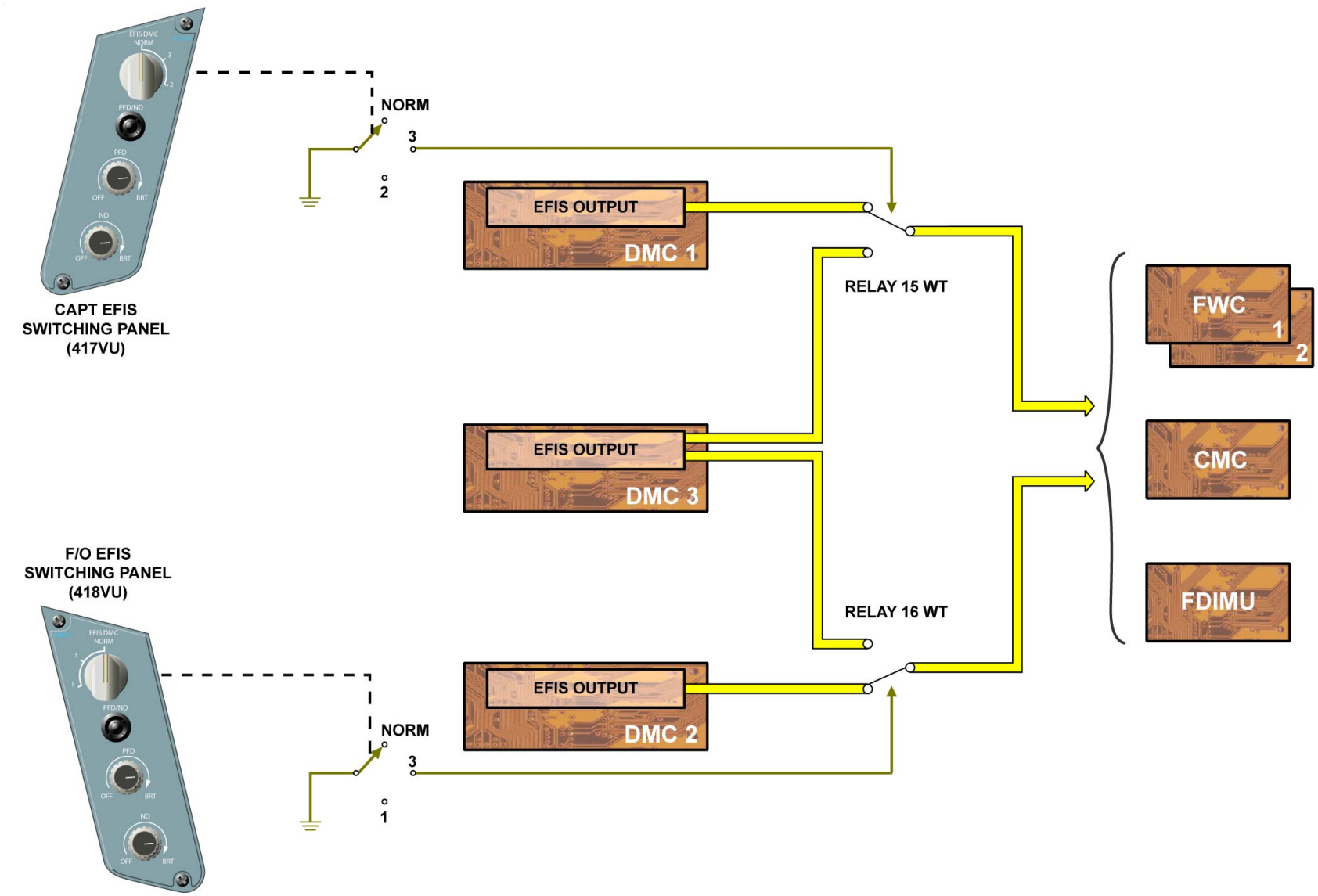
## EIS SWITCHING

The reconfiguration function is achieved by a set of external relays, separated from the DMCs and the DUs. Additional switching devices and software are implemented within the DMCs and the DUs. These reconfigurations can be done manually or automatically.

### EFIS OUTPUT BUS

The switching of the EFIS output bus connected to the systems is controlled by the EFIS DMC rotary selectors and a set of two relays. For each side, the selected DMC transmits the information on the bus to the FWCs, CMC and FDIMU.

G9409341 - GAUT0T0 - FM31D2000000002




EIS SWITCHING - EFIS OUTPUT BUS

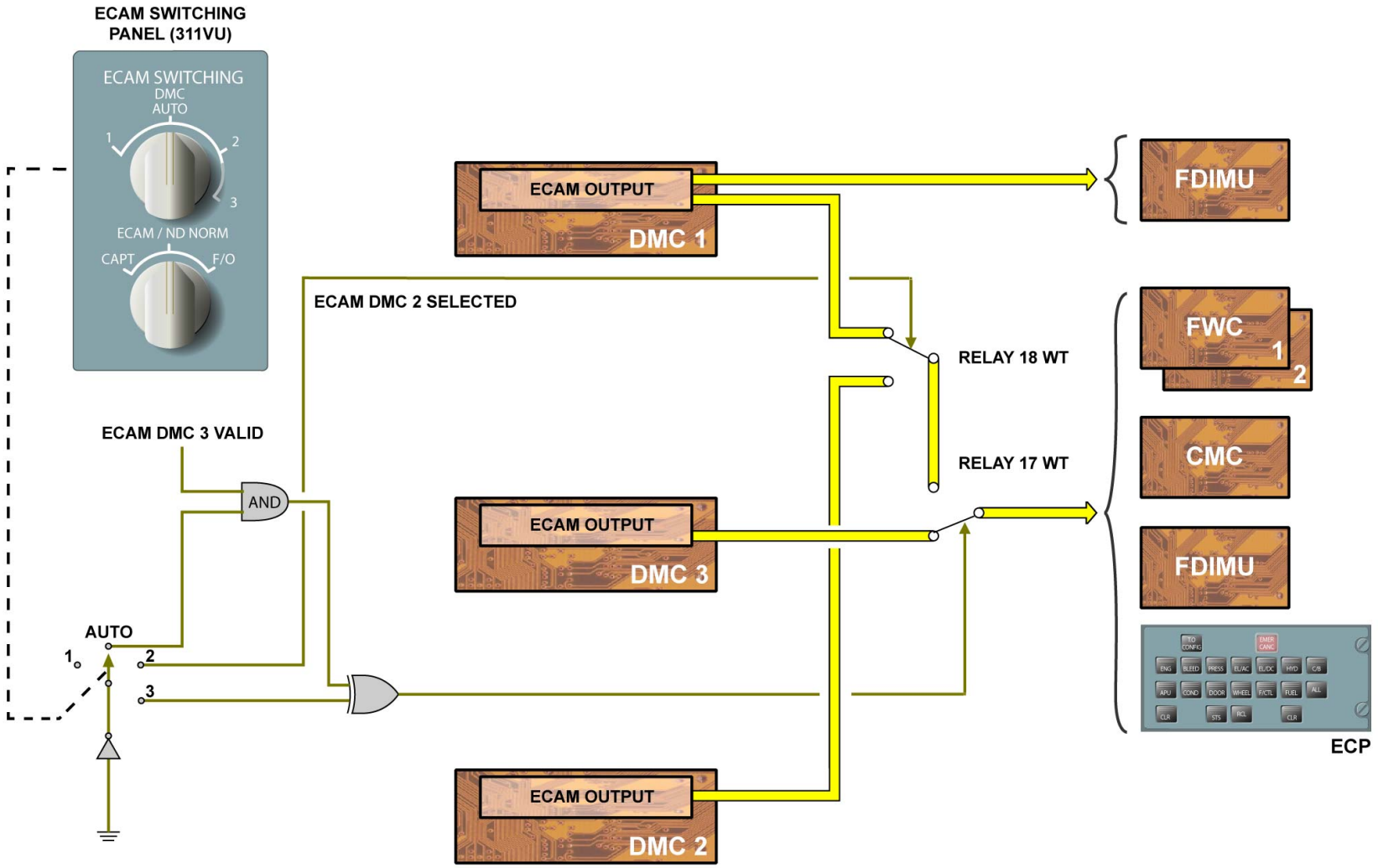
# EIS D/O (3)

## EIS SWITCHING (continued)

### ECAM OUTPUT BUS

There are two ECAM output buses connected to other systems.
One of the output buses is connected directly to the FDIMU from ECAM DMC1.
The switching of the second bus is done by a set of two relays controlled by the DMC ECAM switching rotary selector.
The active DMC transmits data on the bus to the FWCs, CMC, ECP, and FDIMU.

G9409341 - GAUT0T0 - FM31D2000000002




EIS SWITCHING - ECAM OUTPUT BUS

G9409341 - GAUT0T0 - FM31D2000000002

# EIS D/O (3)

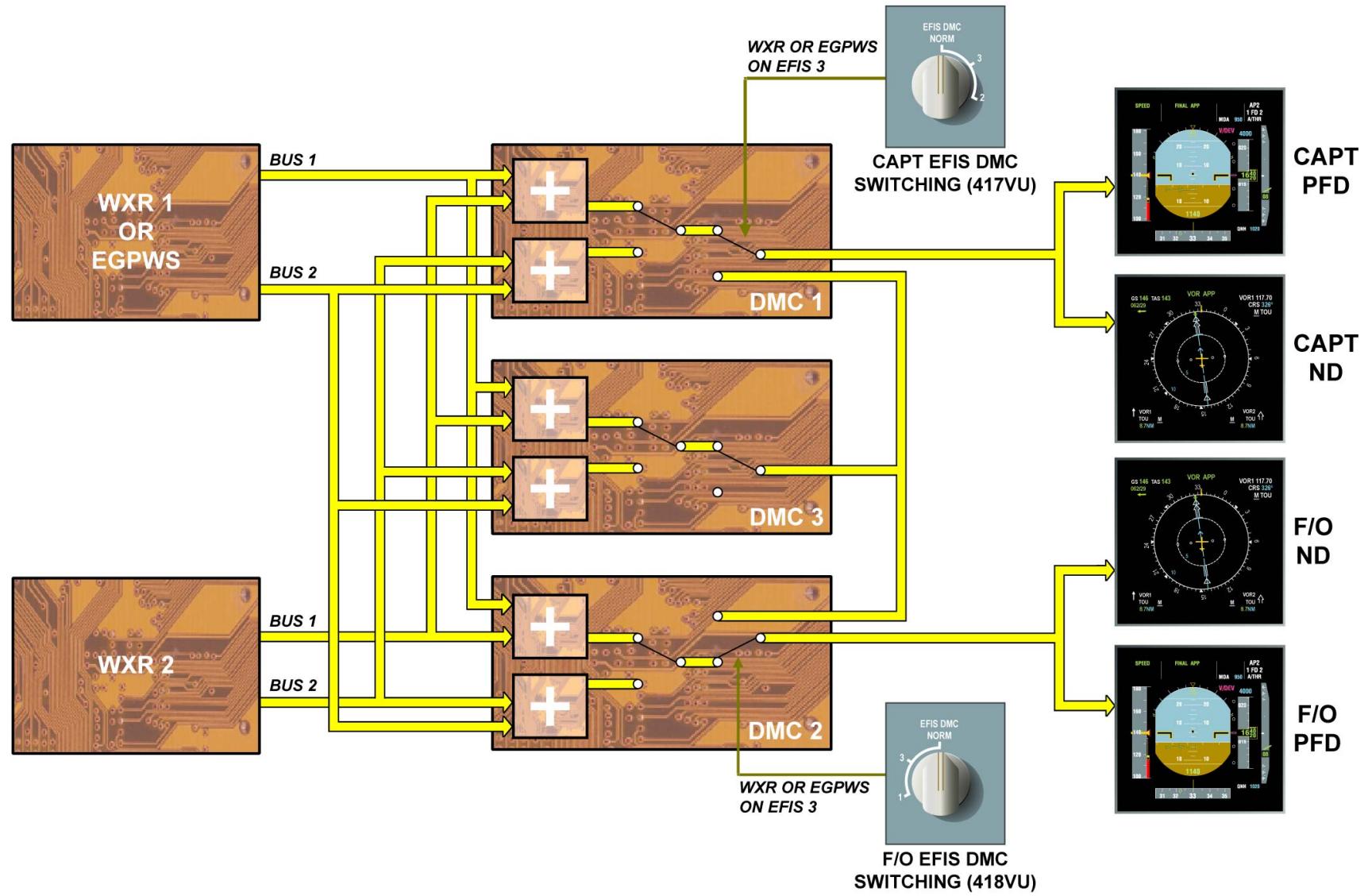
## EIS SWITCHING (continued)

### WEATHER RADAR/EGPWS SWITCHING

Each DMC can receive 5 ARINC 453 inputs:
- data bus 1 and 2 from Weather Radar (WXR) transceiver 1 or EGPWS,
- data bus 1 and 2 from WXR transceiver 2,
- data bus from the DMC 3 ARINC 453 output.

The switching between bus 1 and bus 2 is directly linked to Flight Management (FM). The DMC uses BUS 1 when it uses the FM 1 bus or BUS 2 when the FM 2 bus is used. The switching is performed by a set of two relays inside each DMC. In normal operation, EFIS DMC 1 and EFIS DMC 2 directly supply the CAPT and F/O DUs. The bus 1 signals from both transceivers are electrically added in the DMC. The same thing applies for the bus 2 signals, the DMC then supplies one ARINC 453 output bus to the associated DUs. When EFIS DMC 3 is selected with the CAPT or F/O EFIS DMC switching, the discrete signal WXR on EFIS 3 is activated and the WXR information is sent through DMC1 or DMC 2. The discrete signal WXR ON EFIS 3 is a ground. Note that the CAPT cannot display the WXR data on his DUs by setting the EFIS DMC rotary selector to 2. The same thing applies for the F/O with the EFIS DMC rotary selector set to 1.

G9409341 - GAUT0T0 - FM31D2000000002




EIS SWITCHING - WEATHER RADAR/EGPWS SWITCHING

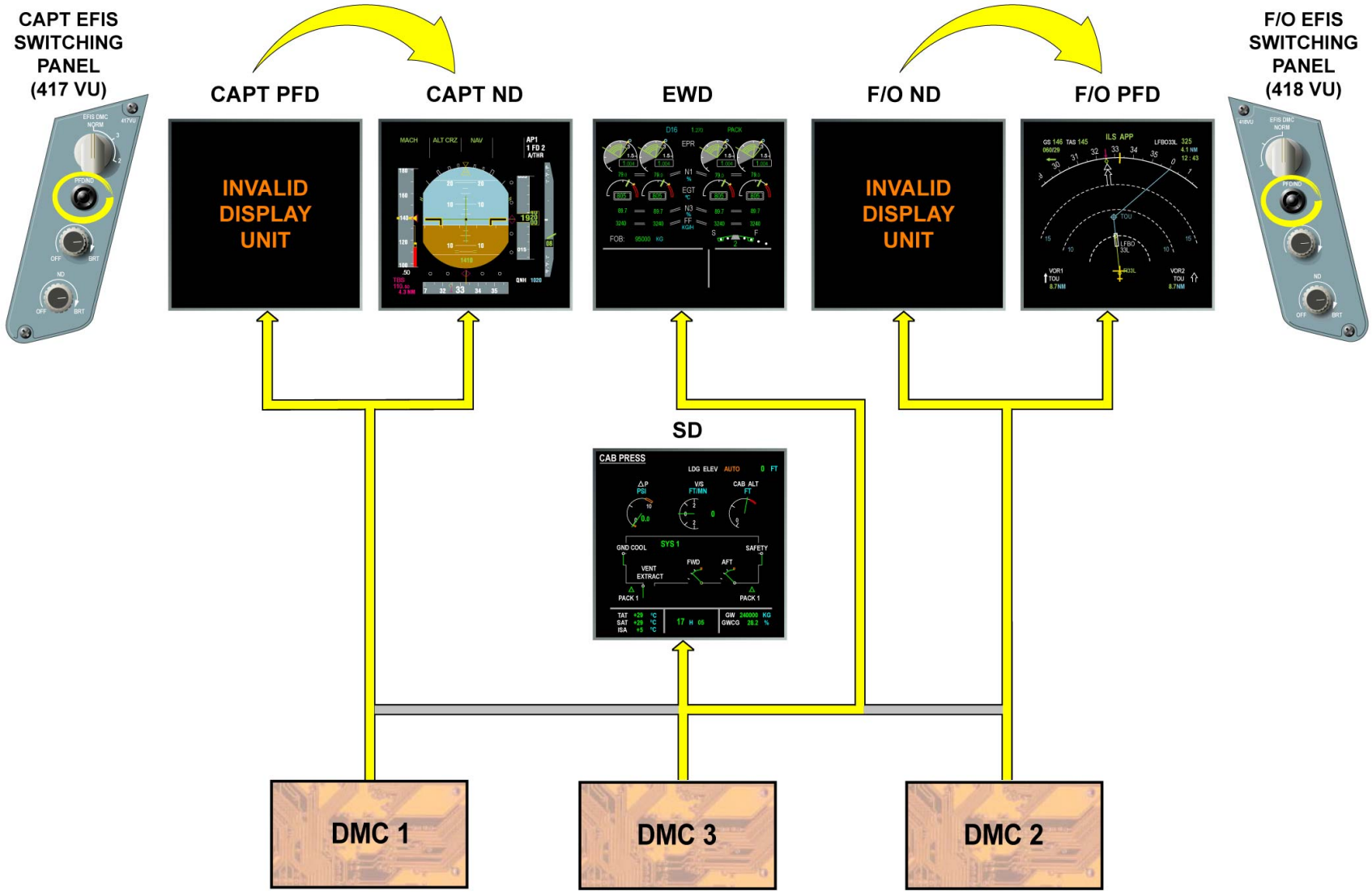
G9409341 - GAUT0T0 - FM31D2000000002

# EIS ABNORMAL OPERATION (3)

## PFD OR ND FAILURE

When the Primary Flight Display (PFD) fails or is switched off, the PFD image is transferred automatically on the Navigation display (ND). In this case, it is possible to recover the ND image by pushing the PFD/ND transfer P/B. When the ND fails or is switched off, the ND image can be manually recovered on the PFD by using the PFD/ND transfer P/B.

G9409341 - GAUT0T0 - FM31DA000000002




PFD OR ND FAILURE

# EIS ABNORMAL OPERATION (3)

## EWD/SD FAILURES

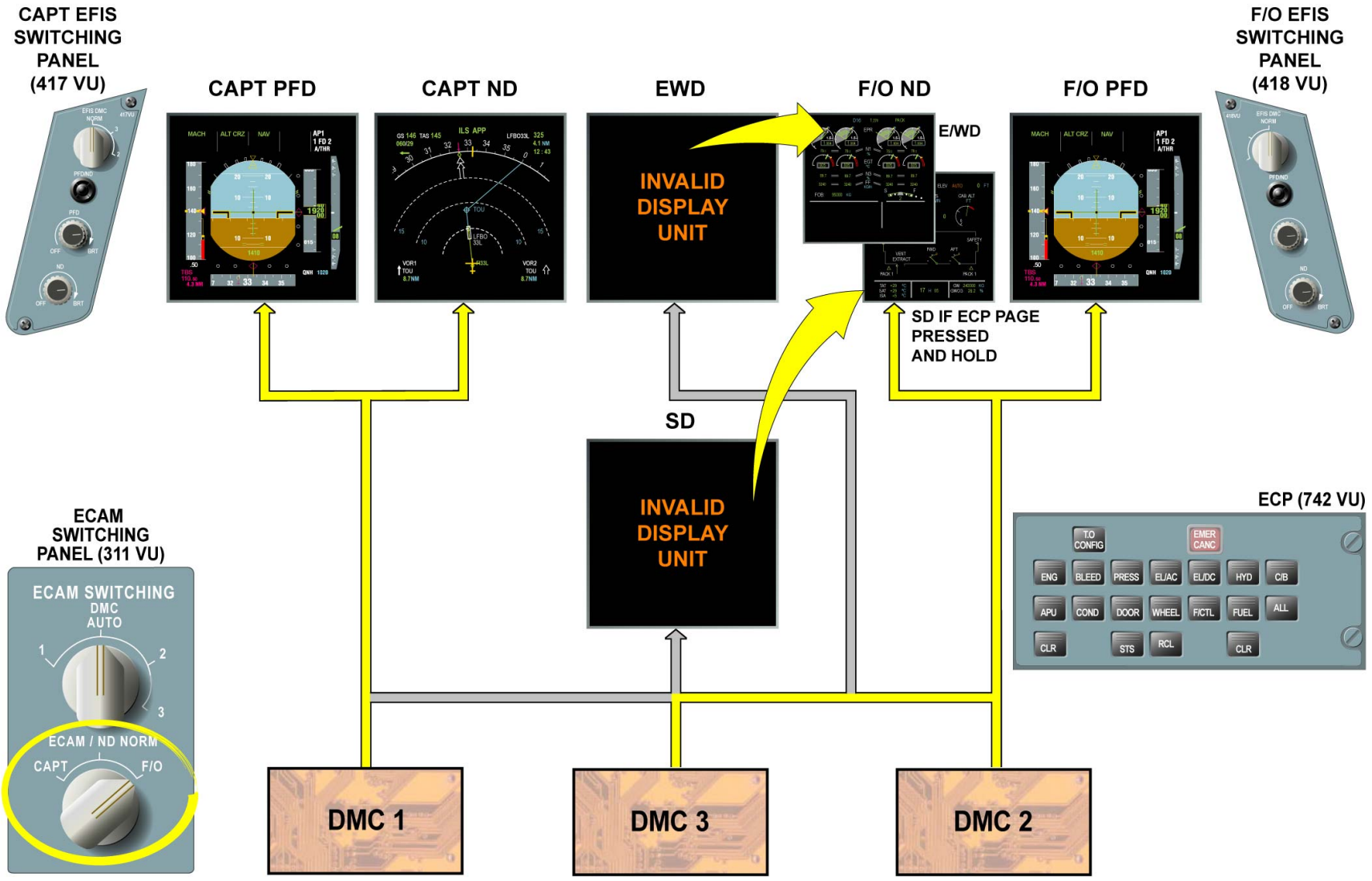
### EWD OR SD FAILURE

When the Engine/Warning Display (EWD) fails or is switched off, the EWD image is automatically transferred to the System Display (SD). In this case only one Display Unit (DU) is available to show the ECAM displays, this is called the ECAM SINGLE DISPLAY mode. In this mode, the EWD has priority but a system page can be displayed momentarily by pressing and holding one of the system keys on the ECAM Control Panel (ECP). If the failure happens on the lower display, the EWD is presented on the upper display and this is also in ECAM SINGLE DISPLAY mode. In these failure cases, the pilots may use the ECAM/ND transfer selection to recover a second ECAM display on the ND.

### EWD AND SD FAILURE

If both ECAM DUs fail or are switched off, the crew can display the EWD image on the ND by switching the ECAM/ND transfer selector to CAPT or F/O. This is then an ECAM SINGLE DISPLAY mode, but in this case ECAM is presented on the ND.

G9409341 - GAUT0T0 - FM31DA000000002




EWD/SD FAILURES - EWD OR SD FAILURE & EWD AND SD FAILURE

G9409341 - GAUT0T0 - FM31DA000000002

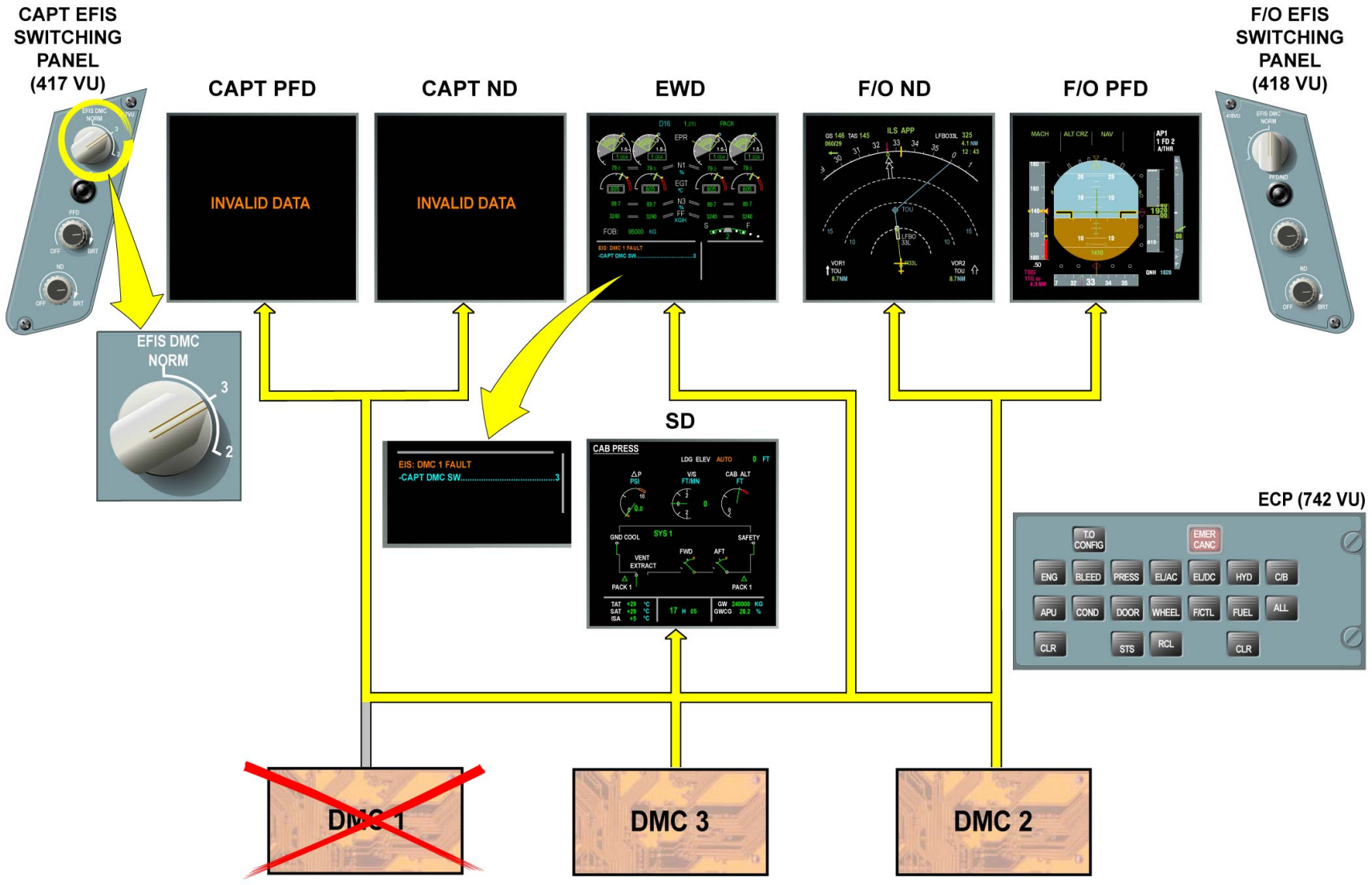
# EIS ABNORMAL OPERATION (3)

## DMC FAILURE

### DMC 1 (2) FAILURE

In normal configuration, captain (F/O) PFD and ND are affected by the failure of the Display Management Computer 1(2) (DMC). In this case a caution message appears on the EWD and the amber message 'INVALID DATA' is displayed in the center of the PFD and ND. So the captain (F/O) must switch to DMC3 to recover the PFD and ND information.

G9409341 - GAUT0T0 - FM31DA000000002




DMC FAILURE - DMC 1 (2) FAILURE

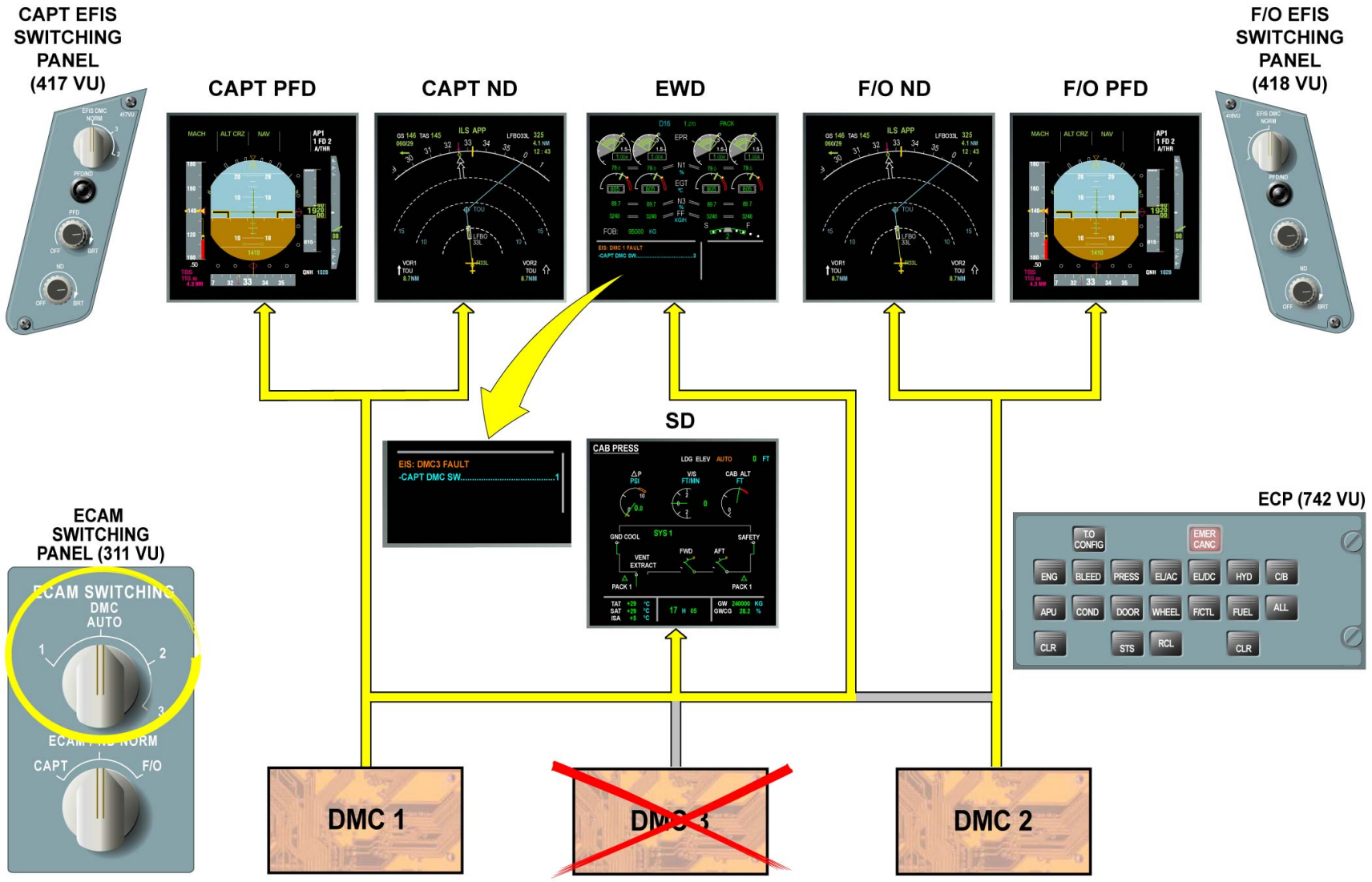
# EIS ABNORMAL OPERATION (3)

## DMC FAILURE (continued)

### DMC 3 FAILURE

When the DMC3 fails, the DMC1 takes over automatically but not immediately (a message is displayed on both EWD and SD for 1 second: "INVALID DATA"). The crew is then asked to switch the ECAM SWITCHING/DMC selector switch to the position 1 to confirm this DMC 1 selection.

G9409341 - GAUT0T0 - FM31DA000000002




DMC FAILURE - DMC 3 FAILURE

G9409341 - GAUT0T0 - FM31DA000000002

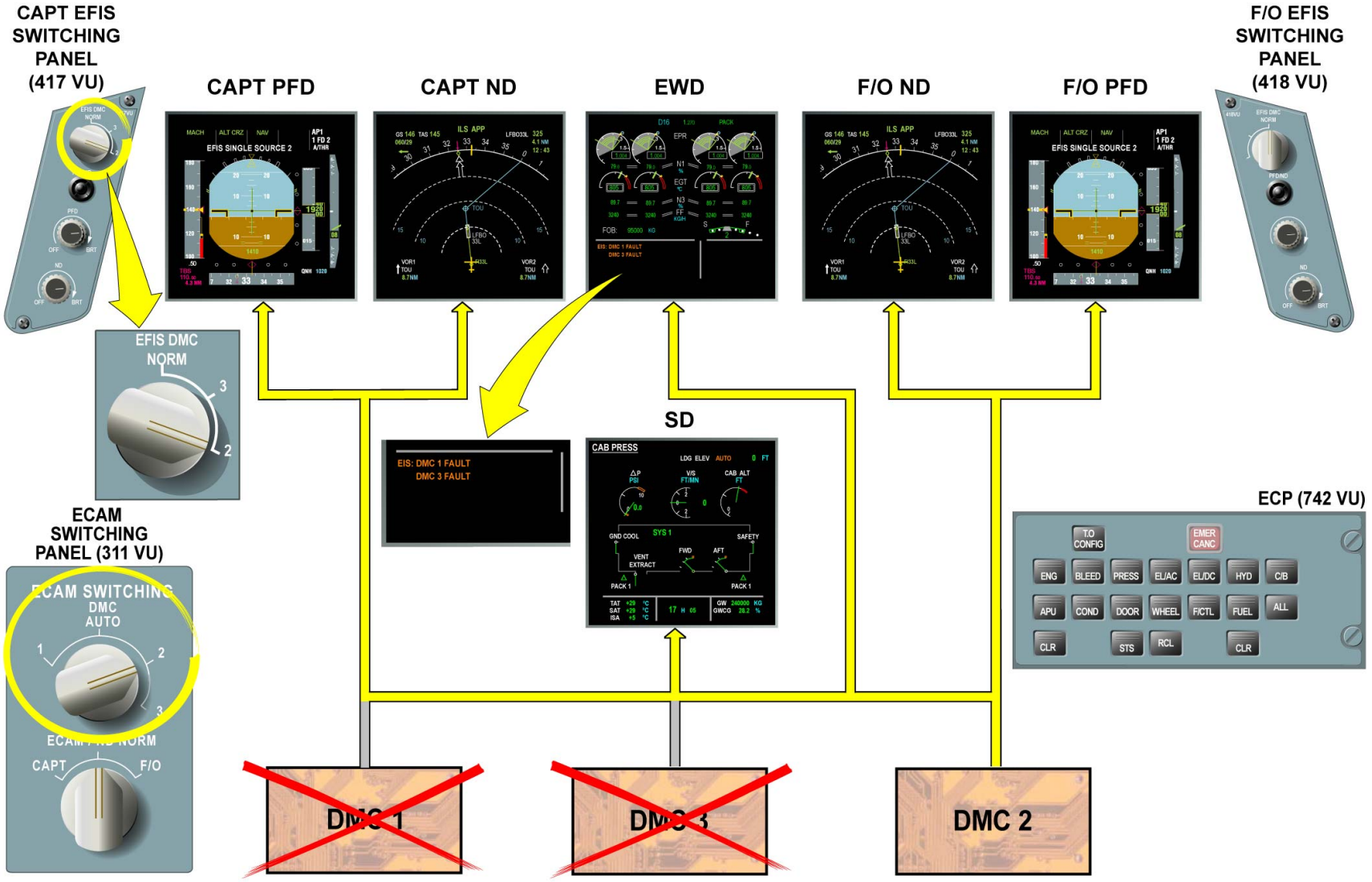
# EIS ABNORMAL OPERATION (3)

## DMC FAILURE (continued)

### DMC 1+3 FAILURE

When DMC 1 and 3 fail, the system is under a degraded redundancy. On the CAPT PFD, ND, EWD and SD, the amber message 'INVALID DATA' is displayed in the center of the displays. The CAPT must switch the EFIS DMC SELECTOR and the ECAM DMC SWITCHING to the position 2. In this case a caution message appears on the EWD. The consequence is that DMC 2 drives the 6 DUs. The message 'EFIS SINGLE SOURCE 2' is displayed on both PFDs (COPY mode).

G9409341 - GAUT0T0 - FM31DA000000002




DMC FAILURE - DMC 1+3 FAILURE

G9409341 - GAUT0T0 - FM31DA000000002

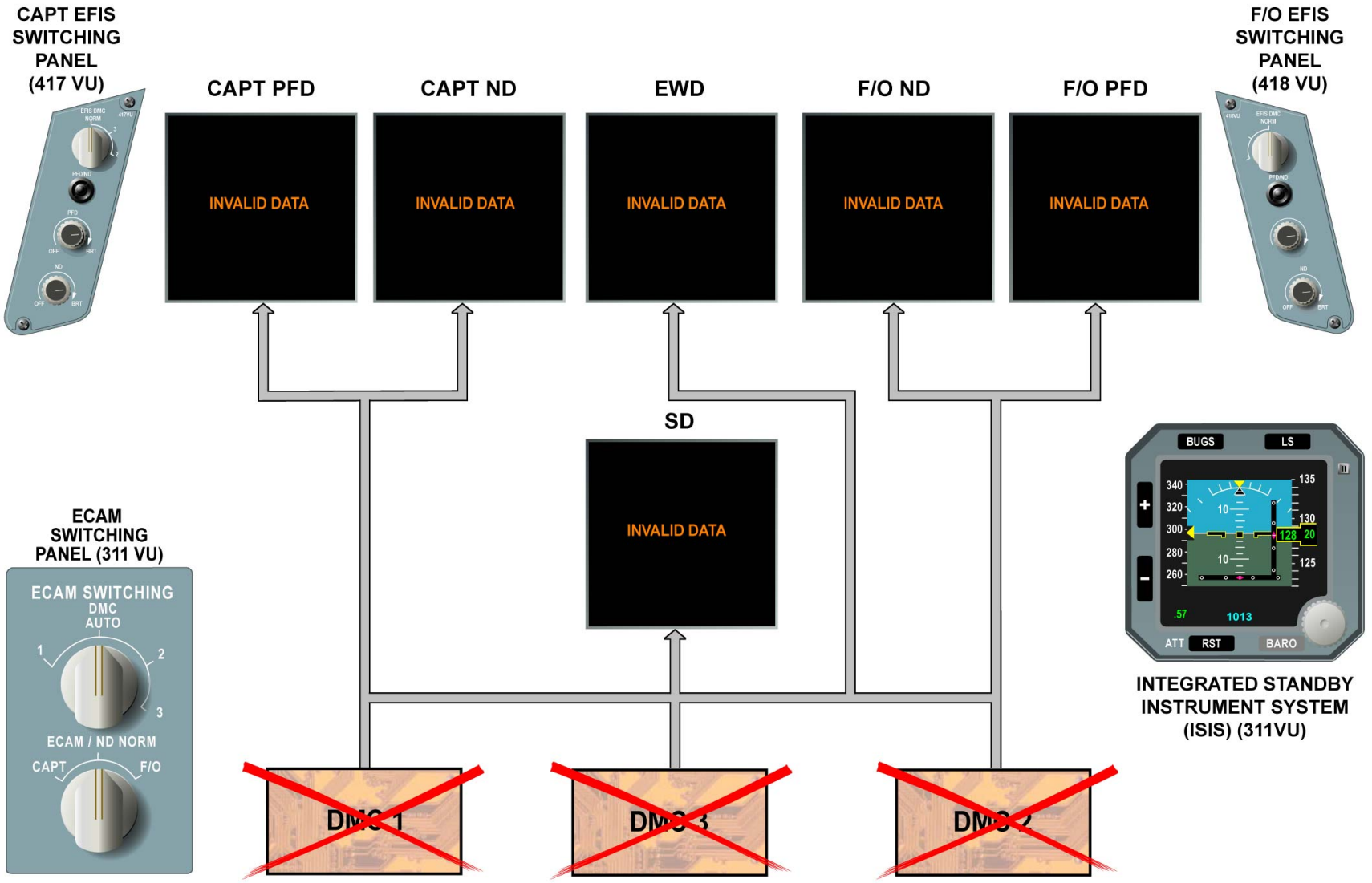
# EIS ABNORMAL OPERATION (3)

## DMC FAILURE (continued)

### DMC 1+2+3 FAILURE

In case of a triple DMC failure no more EFIS and ECAM information is presented, the amber message INVALID DATA is displayed on the 6 DUs. The crew has to use the Integrated Standby Instrument System (ISIS).

G9409341 - GAUT0T0 - FM31DA000000002




DMC FAILURE - DMC 1+2+3 FAILURE

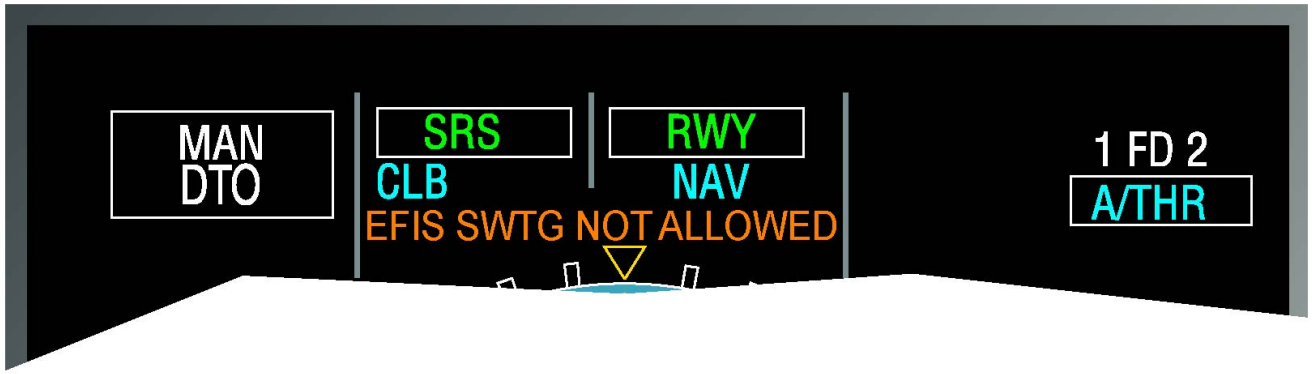
# EIS ABNORMAL OPERATION (3)

## EFIS SWITCHING NOT ALLOWED

Some EFIS switching are not allowed because they can cause unusual configurations of the system. In case the crew wants to switch some of these configurations, an amber message comes into view on the PFD.

G9409341 - GAUT0T0 - FM31DA000000002

PRIMARY FLIGHT DISPLAY (PFD) UPPER PART




| CAPT EFIS DMC | F/O EFIS DMC |
|---|---|
| DMC 2 | DMC 1 |
| DMC 2 | DMC 3 |
| DMC 3 | DMC 1 |

EFIS SWITCHING NOT ALLOWED

# EIS ABNORMAL OPERATION (3)

## FWC FAILURE

When one Flight Warning Computer (FWC) 1(2) fails, the other one takes over automatically. Half of the bulbs in each MASTER WARNing and MASTER CAUTion annunciators are lost. When this failure occurs a caution message appears on the EWD indicating which FWC has failed.
After the loss of both FWCs, the ECAM warnings are not available as well as:
- altitude alert,
- status,
- auto call out,
- memo.

In this case, a caution message appears on the EWD:
FWS: FWC 1+2 FAULT
MONITOR SYS,
MONITOR OVERHEAD PANEL.
The SD is still available and must be used for system checks.

## SDAC FAILURE

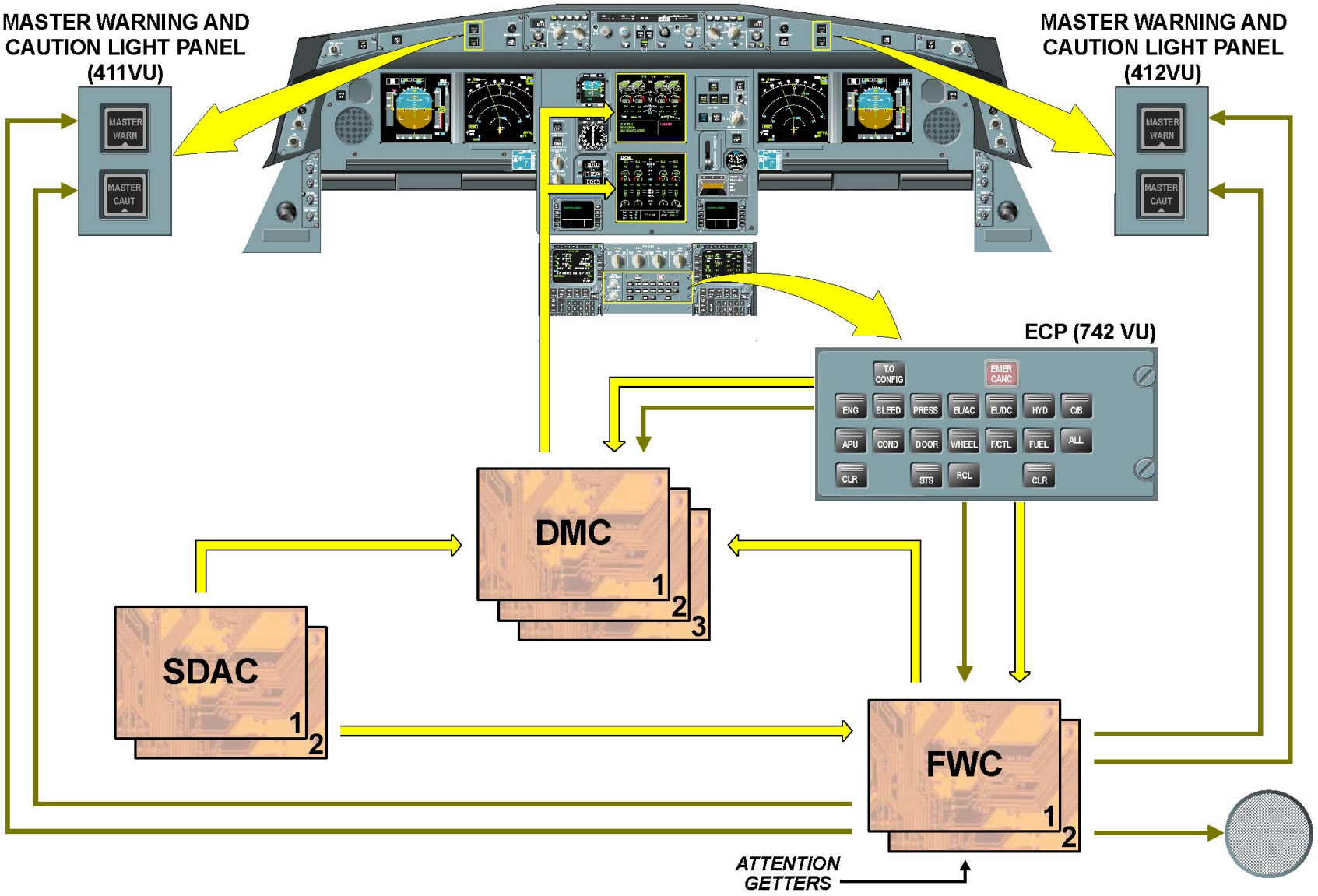
When one SDAC 1(2) fails, the other one takes over automatically. When this failure occurs a caution message appears on the EWD, indicating which SDAC has failed.
After the loss of both SDACs, most of the amber caution messages are lost but all red messages are still available on the EWD. On the SD, some system pages are still available. When this failure occurs a caution message appears on the EWD:
FWS: SDAC 1+2 FAULT
MONITOR OVERHEAD PANEL,
ECAM SYS PAGES AVAIL:
ENG, F/CTL, FUEL, WHEEL, PRESS, C/B.

## ECP FAILURE

In case of the ECAM Control Panel (ECP) failure, the following keys are still available:
- ALL,
- CLeaR,
- ReCalL,
- StaTuS,
- EMERgency CANCel,

In this case a caution message appears on the EWD:
FWS: ECP FAULT
ECP KEYS AVAIL:
CLR, RCL, STS, ALL,
EMER CANC.

G9409341 - GAUT0T0 - FM31DA000000002




FWC FAILURE ... ECP FAILURE

G9409341 - GAUT0T0 - FM31DA000000002

# EIS ABNORMAL OPERATION (3)

## FEEDBACK MONITORING

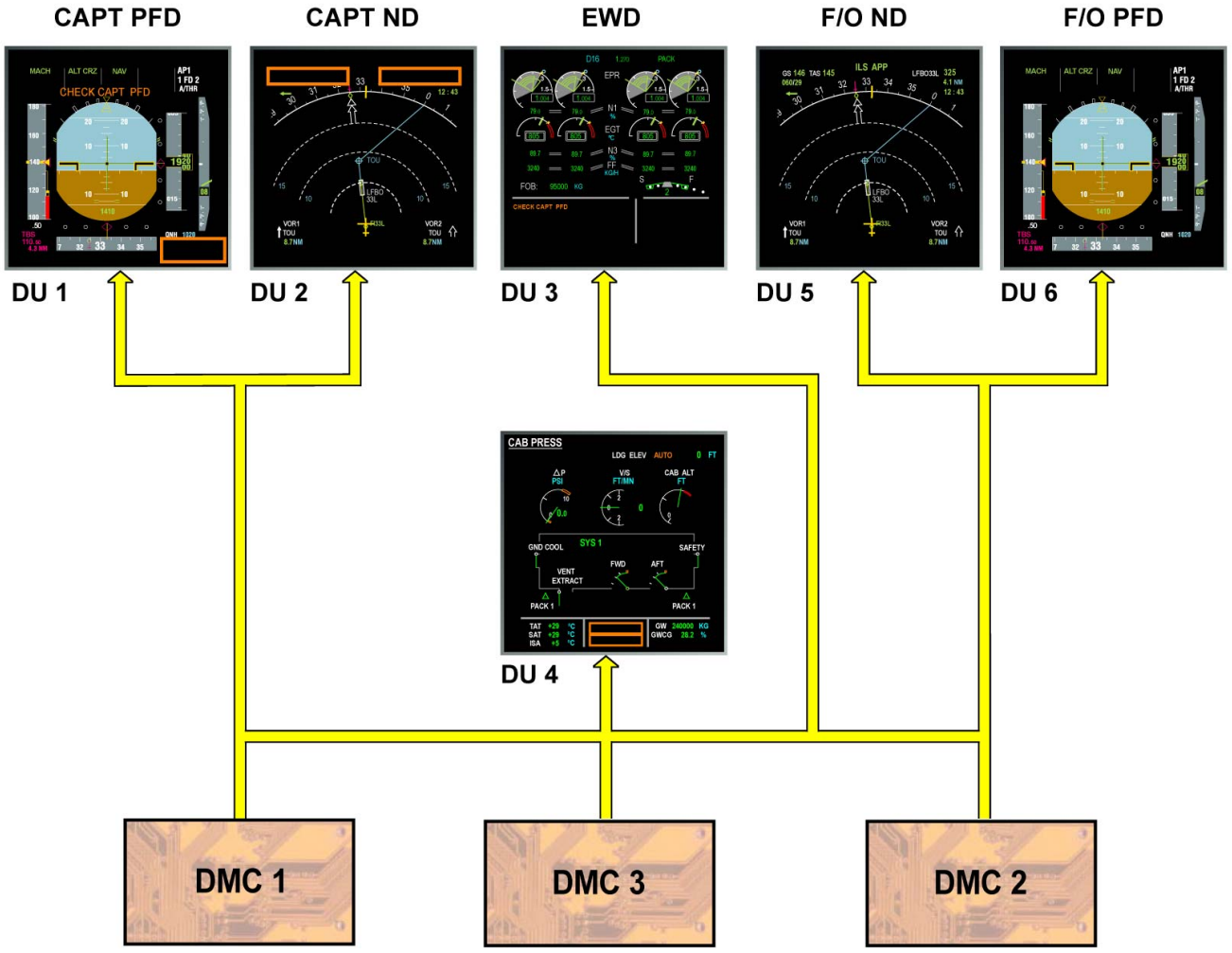
Two other display units monitor each displayed image on a DU and also receive the parameters. As soon as a discrepancy occurs between some main parameters sent by a sensor and what is displayed by the relevant DU, a caution message appears on the monitoring DU. Each DU, according to its position, monitors two different images (wherever they are displayed) as follows:
- DU 1 monitors EWD and F/O ND images,
- DU 2 monitors SD and F/O PFD images,
- DU 3 monitors CAPT PFD and ND images,
- DU 4 monitors F/O PFD and ND images,
- DU 5 monitors CAPT PFD and SD images,
- DU 6 monitors CAPT ND and EWD images.

The following parameters are monitored:
- pitch, roll, heading and altitude indications on PFD,
- heading indication on ND,
- N1, N2, N3, EGT, Fuel Flow and EPR indications for all the engines on EWD,
- UTC indication (minutes only) on SD.

When a DU triggers an order to display a feedback CHECK message, a specific message is announced by the monitoring DU as follows:
- PFD CAPT discrepancy: CHECK CAPT PFD
- ND CAPT discrepancy: CHECK ND CAPT
- EWD discrepancy: CHECK EWD
- SD discrepancy: CHECK SD
- ND F/O discrepancy: CHECK ND FO
- PFD F/O discrepancy: CHECK PFD FO

NOTE: Additionally to the monitoring DU, for the CHECK PFD (CAPT or F/O), the CHECK PFD CAPT or FO message is also displayed on the monitored PFD.

G9409341 - GAUT0T0 - FM31DA000000002




FEEDBACK MONITORING

# EIS ABNORMAL OPERATION (3)

## DU MESSAGES

The following table summarizes all the other messages displayed by the DUs on a black screen.

G9409341 - GAUT0T0 - FM31DA000000002

| DU MESSAGE | DETAILS | MEANING |
|---|---|---|
| BLANK SCREEN | / | - DISPLAY UNIT IN OFF POSITION<br>- DISPLAY UNIT FAILURE CASES WHERE THE INTEGRITY OF THE DISPLAY CAN NO LONGER BE WARRANTED<br>- DISPLAY UNIT NOT POWERED |
| DISPLAY SYSTEM VERSION INCONSISTENCY | AMBER MESSAGE CENTERED ON THE SCREEN | - IF AN OPERATIONAL IMAGE AND THE MESSAGE ARE DISPLAYED, THE DISPLAY UNIT AND AN INACTIVE DMC HAVE DIFFERENT EIS SOFTWARE VERSION<br>- IF ONLY THE MESSAGE IS DISPLAYED, THE DISPLAY UNIT AND ITS ACTIVE DMC HAVE DIFFERENT EIS SOFTWARE VERSION |
| DMC VERSION INCONSISTENCY | AMBER MESSAGE CENTERED ON THE SCREEN | EIS LOADED SOFTWARE INSIDE THE ACTIVE DMC IS NOT COMPATIBLE WITH A/C TYPE (DMC PIN PROG) |
| E | LARGE WHITE LETTER CENTERED ON THE SCREEN | NONE OPERATIONAL SOFTWARE STORED IN THE DISPLAY UNIT |
| ECAM ON ND | GREEN MESSAGE CENTERED ON THE SCREEN | ECAM IMAGE IS DISPLAYED ON ND AND BOTH ECAM DISPLAY UNITS ARE VALID |
| F | LARGE AMBER LETTER CENTERED ON THE SCREEN | DISPLAY UNIT IS UNSERVICEABLE |

DU MESSAGES

| DU MESSAGE | DETAILS | MEANING |
|---|---|---|
| DU NOT MONITORED | AMBER MESSAGE CENTERED ON THE SCREEN | - IF A DISPLAY UNIT IS NO MORE MONITORED BY ANOTHER DISPLAY UNIT |
| INVALID DATA | AMBER MESSAGE CENTERED ON THE SCREEN | DISPLAY UNIT DOES NOT RECEIVE ANY DATA FROM A DMC |
| INVALID DISPLAY UNIT | AMBER MESSAGE CENTERED ON THE SCREEN | - POWER ON SELF TEST (POST) RESULT NOT OK<br>- DISPLAY UNIT COMPATIBILITY CHECK NOT OK |
| L | LARGE CYAN LETTER CENTERED ON THE SCREEN | DISPLAY UNIT IS TELELOADED |
| MAINTENANCE MODE | GREEN MESSAGE CENTERED ON THE SCREEN | EIS IS IN MAINTENANCE MODE |
| PLEASE WAIT | GREEN MESSAGE CENTERED ON THE SCREEN | DISPLAYED FOR 1 SECOND DURING OPERATIONAL IMAGE/VIDEO TRANSITION |

DU MESSAGES

G9409341 - GAUT0T0 - FM31DA000000002

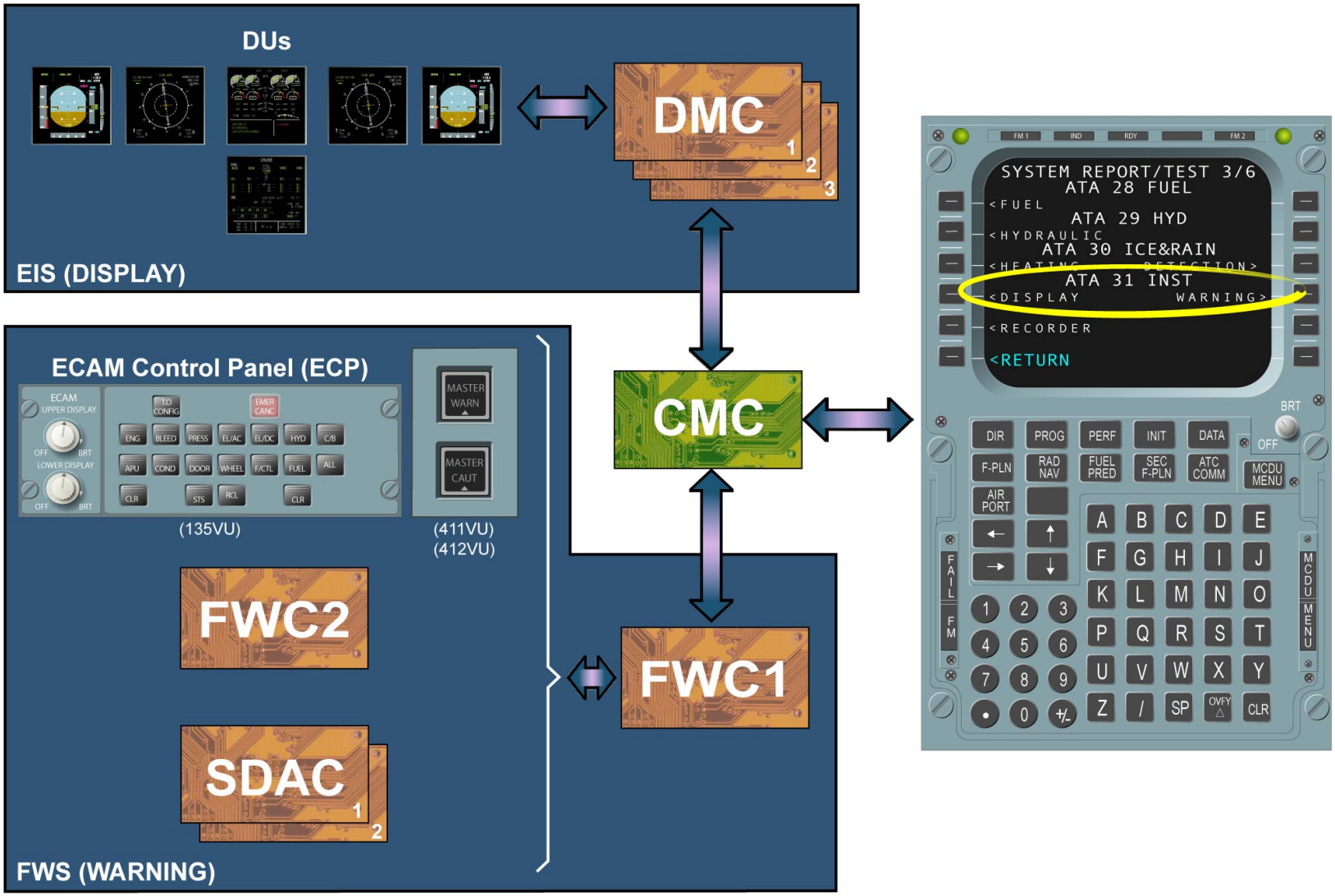
| DU MESSAGE | DETAILS | MEANING |
|---|---|---|
| SELF TEST IN PROGRESS (MAX XX SECONDS) | GREEN MESSAGE CENTERED ON THE SCREEN | DISPLAY UNIT IS IN POWER ON SELF TEST (POST) |
| VIDEO NOT AVAIL | AMBER MESSAGE CENTERED ON THE SCREEN | VIDEO NOT AVAILABLE |
| WAITING FOR DATA (MAX XX SECONDS) | GREEN MESSAGE CENTERED ON THE SCREEN | DMC ARINC 629 COMMUNICATION IS TO BE ESTABLISHED |

# INDICATING SYSTEMS MCDU PAGES

## GENERAL

The Indicating system Built in Test Equipment (BITE) is divided into an Electronic Instrument System (EIS) BITE and a Flight Warning System (FWS) BITE.
The EIS BITE is fulfilled by each Display Management Computer (DMC) and each Display Unit (DU). Each DMC does an interface with the Central Maintenance Computer (CMC) and reports the failure information associated with the DMCs, DUs and their related wiring.
The FWS BITE is fulfilled by each Flight Warning Computer (FWC), each System Data Acquisition Concentrator (SDAC) and the ECAM Control Panel (ECP), but only FWC1 does the FWS interface with the CMC. FWC 1 reports failures related to the FWCs, SDACs, ECP, and their associated wiring.
The Indicating system BITE information is available through the MCDU SYSTEM REPORT TEST page (ATA 31 INST).

G9409341 - GAUT0T0 - FM31P9MCDUTST02


DUs
DMC
1
2
3
EIS (DISPLAY)
ECAM Control Panel (ECP)
ECAM
UPPER DISPLAY
LOWER DISPLAY
TO CONFIG
EMER CANC
ENG
BLEED
PRESS
EL/AC
EL/DC
HYD
C/B
APU
COND
DOOR
WHEEL
F/CTL
FUEL
ALL
CLR
STS
RCL
CLR
MASTER WARN
MASTER CAUT
(135VU)
(411VU)
(412VU)
CMC
FWC2
FWC1
SDAC
1
2
FWS (WARNING)
SYSTEM REPORT/TEST 3/6
ATA 28 FUEL
<FUEL
ATA 29 HYD
<HYDRAULIC
ATA 30 ICE&RAIN
ATA 31 INST
<DISPLAY
WARNING>
<RECORDER
<RETURN
DIR
PROG
PERF
INIT
DATA
F-PLN
RAD NAV
FUEL PRED
SEC F-PLN
ATC COMM
MCDU MENU
AIR PORT
BRT
OFF
FAIL
FM
MCDU MENU
CLR

GENERAL

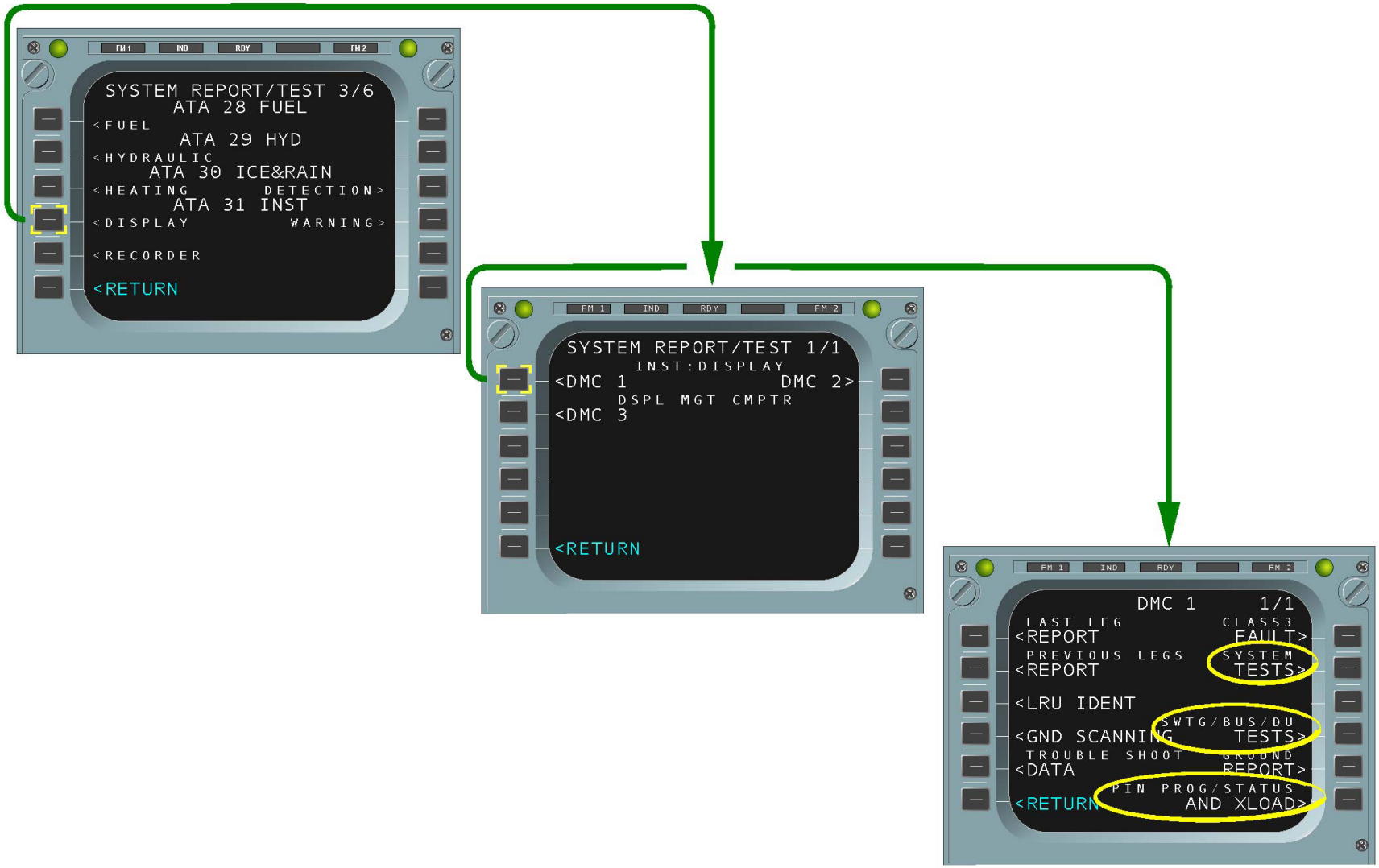
# INDICATING SYSTEMS MCDU PAGES

## EIS MCDU MENU CAPABILITY

The SYSTEM REPORT/TEST page lets the operator select the ATA 31 INST DISPLAY function in order to interrogate the EIS SYSTEM for failure, report display and testing.
The selection of one of the 3 DMCs will access the related DMC BITE page. Each DMC is a TYPE1 computer with a BITE menu providing a GND SCANNING selection and the following specific functions: DMC self test, SWITCHING/BUS/DU test, Pin Programming/Status AND XLOAD.
The SYSTEM TEST function does the automatic test of the EIS and a display visual check. The system test fulfills the following functions:
- a DMC self test,
- a DMC/DUs ARINC 629 link test,
- a connected DUs self test,
- a display check.

Note that this test is used in service whenever a DMC or DU is replaced to check that the Line Replacement Unit (LRU) has not undergone any damage during installation.
The SWTG/BUS/DU TESTS function makes a manual check of the EIS reconfiguration, by operation of switching selectors, as well as an automatic test of the data bus links between the selected DMC, the other DMCs and DUs. It also includes a DU brightness test.
The PIN PROG/STATUS AND XLOAD function lets the operator check the hardware and software pin program status of the selected DMC as well as the status of several bulbs in the light box of the DUs related to the DMC. A XLOAD function is also available to update the software contents of the DMCs or DUs after replacement.
Note that, when one of the three DMC is in interactive mode, a MAINTENANCE MODE message is displayed on the DUs driven by the DMC. This message is not displayed during execution of, the SWITCHING TEST, GND SCANNING, the various DISPLAY TEST, and the DU teleloading function PIN PROG/STATUS AND XLOAD.

G9409341 - GAUT0T0 - FM31P9MCDUTST02

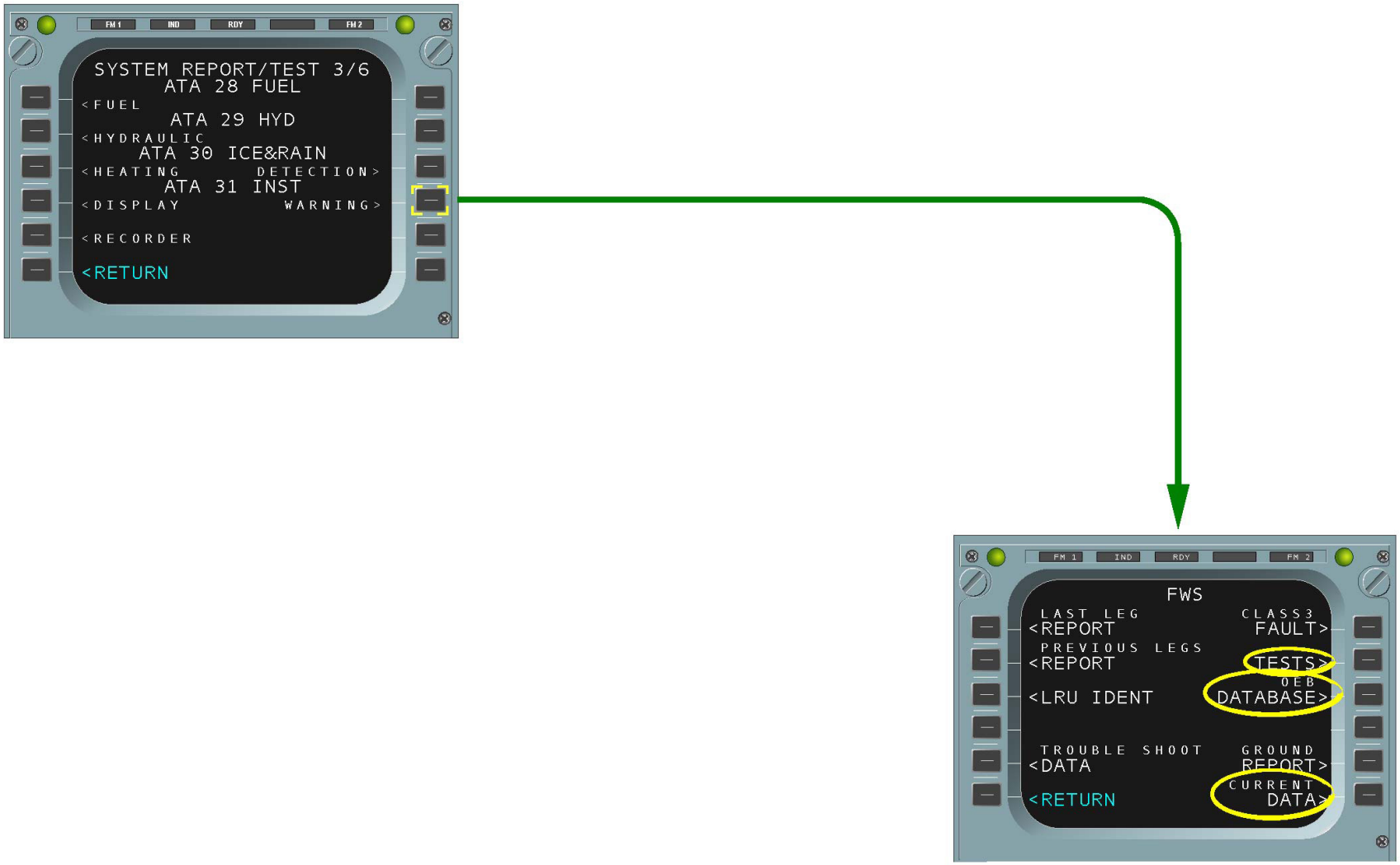



EIS MCDU MENU CAPABILITY

# INDICATING SYSTEMS MCDU PAGES

## FWS MCDU MENU CAPABILITY

The SYSTEM REPORT/TEST page lets the operator select the ATA 31 INST WARNING function in order to interrogate the FWS SYSTEM BITE for failure, report display and testing.
The FWS is a TYPE1 system with a BITE menu, without a GROUND SCANNING menu and supplies the following specific functions.
The FWS TEST is not an automatic test. It requests an operator's manual reset activation as well as visual and aural checks.
The tests done for each SDAC and FWC have a Power On Self Test (POST), monitoring of the ARINC input buses, check of the AUDIO output signals and of the Master Warning and Master Caution lights. It also monitors the status of the ECP.
The Operating Engineering Bulletin (OEB) DATABASE function lets the operator compare and display the content of the FWC 1 and 2 OEB database. This function lets also the operator update (creation, deletion, cross loading) the on side or opposite side OEB database as well
The CURRENT DATA function lets the operator display the SDACs and FWCs hardware pin program status and specific data. This specific data is used for scheduled maintenance to check if there are faults called CLASS 3 SAFETY RELATED.




FWS MCDU MENU CAPABILITY

G9409341 - GAUT0T0 - FM31P9MCDUTST02

# INDICATING SYSTEMS LINE MAINTENANCE (2)

## UP LOADING PROCEDURE OF THE DMC1 WITH THE MDDU

NOTE: This procedure is used to update the Display Management Computer (DMC) 1 software (P/N) only. DMC2, and then DMC3, can be cross-loaded from DMC1.
Make sure that the Aircraft is in ground configuration by checking the GND indication displayed in the SD BLEED page.
From the RESET Control panel, open the RESET DMC1 circuit breaker. INVALID DATA will be displayed on the CAPT PFD and ND.
From the Data Loading Selector (DLS) panel select DMC1.
Put into the Multipurpose Disk Drive Unit (MDDU) the first disk related to the EIS. READY then WAIT RESPONSE is displayed on MDDU screen.
Close the RESET DMC1 circuit breaker. Up loading begins, and the MDDU display shows TRANSF. IN PROG. As soon as the transfer is done EJECT DISK indication is displayed.
Insert the following disk, repeat and monitor the MDDU process until TRANSF COMPLETE indication is displayed.
Remove the last disk from disk drive. <<MDDU READY>> indication appears.
Set the DLS to OFF, after a short delay DISPLAY SYSTEM VERSION INCONSISTENCY comes into view on the CAPT PFD and ND which means that the DMC 1 uploaded software is different from the others DMCs and Liquid Crystal Display Units (LCDUs).
NOTE: DMC 2 and 3 must be cross loaded from DMC 1 by using the CMS System Report Test page of the MCDU. This page also enables to perform the cross loading of the 6 LCDUs in order to get the same software in the complete EIS 2 system. The AMM cross loading procedures must be used accordingly.

G9409341 - GAUT0T0 - FM31Y1LINEMCE02

**UP LOADING Procedure of the DMC1 with the MDDU**

...
Job set-up
...
Make sure that the aircraft is in the GROUND configuration by checking the BLEED SD page, GND is displayed in white.
...
Procedure
...

**UP LOADING the DMC1 operational software**

**On the RESET control panel 261VU (262VU):**
- open the RESET DMC/1 Circuit Breaker.

**On the DATA LOADER control panel 265VU:**
- set the Data Loading Selector switch to DMC1.

**On the MDDU:**
- put the first disk into the disk drive with the label in the forward direction.
- the READY indication is shown, then WAIT RESPONSE.

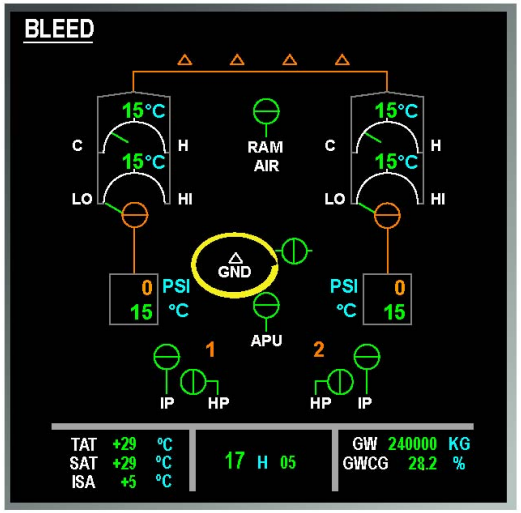
**On the RESET control panel 261VU (262VU):**
- close the RESET DMC/1 Circuit Breaker.

**On the MDDU:**
- remove the disk from the disk drive.
- repeat the steps until there remains a last disk.
- put the last disk into the disk drive.
- remove the last disk from the disk drive.

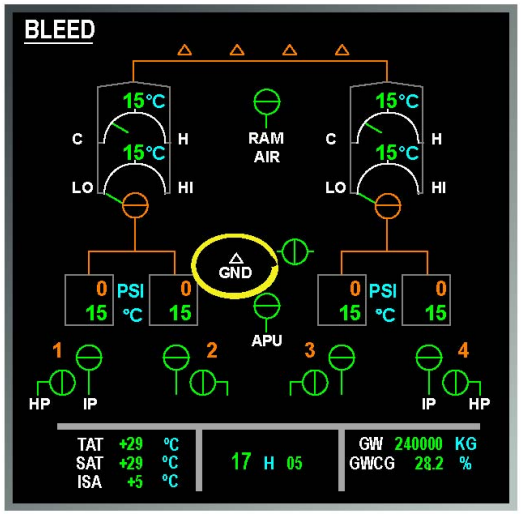
**On the DATA LOADER control panel 265VU:**
- set the Data Loading Selector switch to OFF.

...
Close-up
...

Procedure used only for DMC1 software (P/N) upgrade.




A330 ECAM BLEED PAGE




A340 ECAM BLEED PAGE

UP LOADING PROCEDURE OF THE DMC1 WITH THE MDDU

G9409341 - GAUT0T0 - FM31Y1LINEMCE02

**UP LOADING Procedure of the DMC1 with the MDDU**

...
✓ Job set-up
...
✓ Make sure that the aircraft is in the GROUND configuration by checking the BLEED SD page, GND is displayed in white.
...
Procedure
...

**UP LOADING the DMC1 operational software**

**On the RESET control panel 261VU (262VU):**
- open the RESET DMC/1 Circuit Breaker.

**On the DATA LOADER control panel 265VU:**
- set the Data Loading Selector switch to DMC1.

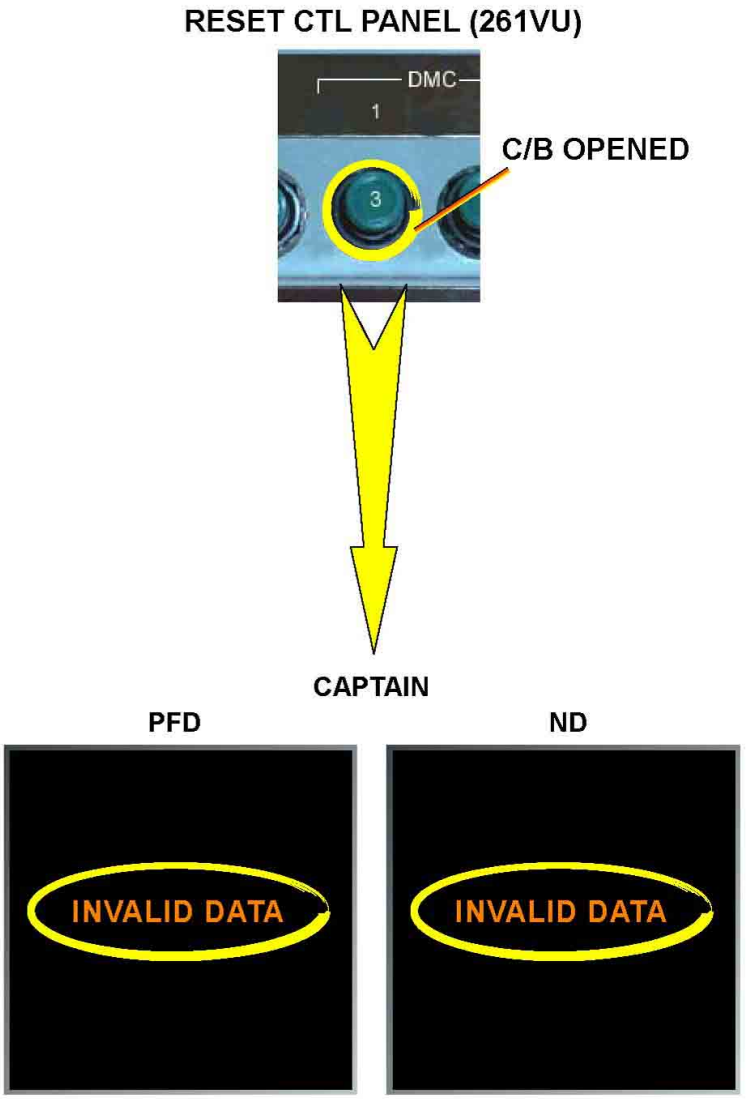
**On the MDDU:**
- put the first disk into the disk drive with the label in the forward direction.
- the READY indication is shown, then WAIT RESPONSE.

**On the RESET control panel 261VU (262VU):**
- close the RESET DMC/1 Circuit Breaker.

**On the MDDU:**
- remove the disk from the disk drive.
- repeat the steps until there remains a last disk.
- put the last disk into the disk drive.
- remove the last disk from the disk drive.

**On the DATA LOADER control panel 265VU:**
- set the Data Loading Selector switch to OFF.

...
Close-up
...




UP LOADING PROCEDURE OF THE DMC1 WITH THE MDDU

**UP LOADING Procedure of the DMC1 with the MDDU**

...
Job set-up
...

Make sure that the aircraft is in the GROUND configuration by checking the BLEED SD page, GND is displayed in white.

...
Procedure
...

**UP LOADING the DMC1 operational software**

**On the RESET control panel 261VU (262VU):**
- open the RESET DMC/1 Circuit Breaker.

**On the DATA LOADER control panel 265VU:**
- set the Data Loading Selector switch to DMC1.

**On the MDDU:**
- put the first disk into the disk drive with the label in the forward direction.
- the READY indication is shown, then WAIT RESPONSE.

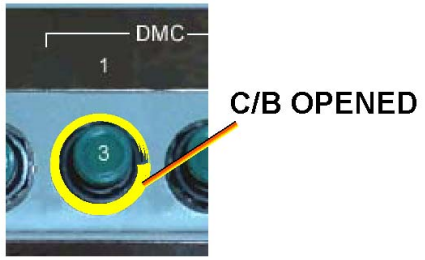
**On the RESET control panel 261VU (262VU):**
- close the RESET DMC/1 Circuit Breaker.

**On the MDDU:**
- remove the disk from the disk drive.
- repeat the steps until there remains a last disk.
- put the last disk into the disk drive.
- remove the last disk from the disk drive.

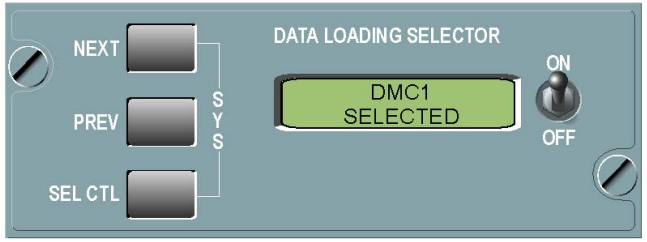
**On the DATA LOADER control panel 265VU:**
- set the Data Loading Selector switch to OFF.

...
Close-up
...

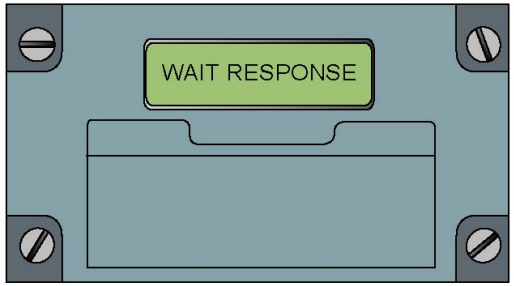
**RESET CTL PANEL (261VU)**




**(265VU)**




**Multipurpose Disk Drive Unit (MDDU)**




UP LOADING PROCEDURE OF THE DMC1 WITH THE MDDU

**UP LOADING Procedure of the DMC1 with the MDDU**

...
Job set-up
...

Make sure that the aircraft is in the GROUND configuration by checking the BLEED SD page, GND is displayed in white.

...
Procedure
...

**UP LOADING the DMC1 operational software**

**On the RESET control panel 261VU (262VU):**
- open the RESET DMC/1 Circuit Breaker.

**On the DATA LOADER control panel 265VU:**
- set the Data Loading Selector switch to DMC1.

**On the MDDU:**
- put the first disk into the disk drive with the label in the forward direction.
- the READY indication is shown, then WAIT RESPONSE.

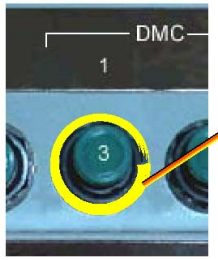
**On the RESET control panel 261VU (262VU):**
- close the RESET DMC/1 Circuit Breaker.

**On the MDDU:**
- remove the disk from the disk drive.
- repeat the steps until there remains a last disk.
- put the last disk into the disk drive.
- remove the last disk from the disk drive.

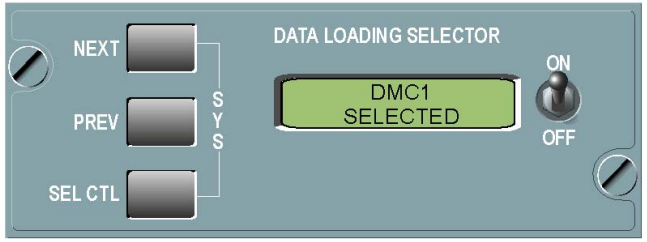
**On the DATA LOADER control panel 265VU:**
- set the Data Loading Selector switch to OFF.

...
Close-up
...

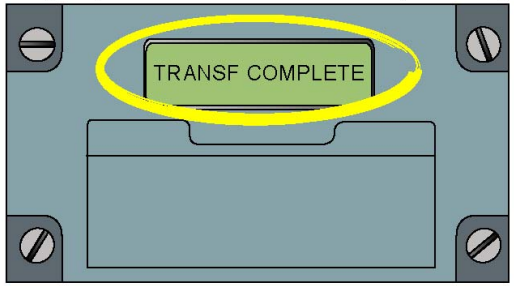
**RESET CTL PANEL (261VU)**




**(265VU)**




**Multipurpose Disk Drive Unit (MDDU)**




UP LOADING PROCEDURE OF THE DMC1 WITH THE MDDU

**UP LOADING Procedure of the DMC1 with the MDDU**

...
Job set-up
...

Make sure that the aircraft is in the GROUND configuration by checking the BLEED SD page, GND is displayed in white.

...
Procedure
...

**UP LOADING the DMC1 operational software**

**On the RESET control panel 261VU (262VU):**
- open the RESET DMC/1 Circuit Breaker.

**On the DATA LOADER control panel 265VU:**
- set the Data Loading Selector switch to DMC1.

**On the MDDU:**
- put the first disk into the disk drive with the label in the forward direction.
- the READY indication is shown, then WAIT RESPONSE.

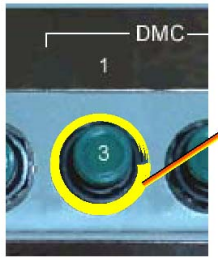
**On the RESET control panel 261VU (262VU):**
- close the RESET DMC/1 Circuit Breaker.

**On the MDDU:**
- remove the disk from the disk drive.
- repeat the steps until there remains a last disk.
- put the last disk into the disk drive.
- remove the last disk from the disk drive.

**On the DATA LOADER control panel 265VU:**
- set the Data Loading Selector switch to OFF.

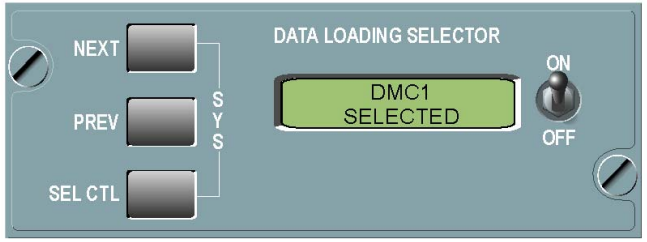
...
Close-up
...

**RESET CTL PANEL (261VU)**

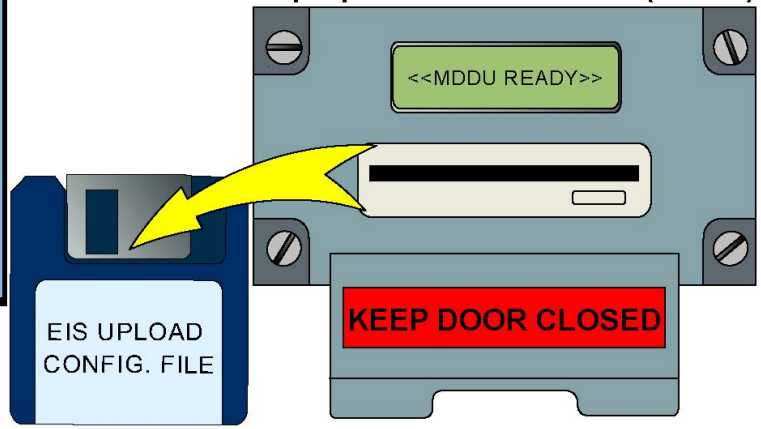



C/B CLOSED

**(265VU)**




**Multipurpose Disk Drive Unit (MDDU)**




UP LOADING PROCEDURE OF THE DMC1 WITH THE MDDU

G9409341 - GAUT0T0 - FM31Y1LINEMCE02

**UP LOADING Procedure of the DMC1 with the MDDU**

...
✓ Job set-up
...

✓ Make sure that the aircraft is in the GROUND configuration by checking the BLEED SD page, GND is displayed in white.

...
✓ Procedure
...

**UP LOADING the DMC1 operational software**

✓ **On the RESET control panel 261VU (262VU):**
- open the RESET DMC/1 Circuit Breaker.

✓ **On the DATA LOADER control panel 265VU:**
- set the Data Loading Selector switch to DMC1.

✓ **On the MDDU:**
- put the first disk into the disk drive with the label in the forward direction.
- the READY indication is shown, then WAIT RESPONSE.

✓ **On the RESET control panel 261VU (262VU):**
- close the RESET DMC/1 Circuit Breaker.

✓ **On the MDDU:**
- remove the disk from the disk drive.
- repeat the steps until there remains a last disk.
- put the last disk into the disk drive.
- remove the last disk from the disk drive.

✓ **On the DATA LOADER control panel 265VU:**
- set the Data Loading Selector switch to OFF.

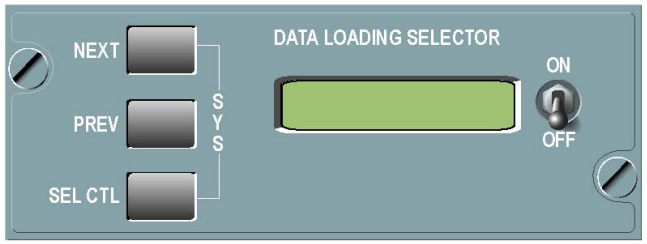
...
✓ Close-up
...

✓ TASK COMPLETED

MCDU/CMS SYSTEM REPORT-TEST page allows to crossload soft of:
- -DMC1 -> DMC2 then DMC3
- -The 6 LCDUs

For this, refer to the AMM crossloading procedures.

(265VU)




CAPTAIN

PFD

ND

UP LOADING PROCEDURE OF THE DMC1 WITH THE MDDU

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AIRBUS

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